

FURUNO

OPERATOR'S MANUAL

THD SATELLITE COMPASS

MODEL SC-50



FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN



(Elemental Chlorine Free)

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9-52 Ashihara-cho,
Nishinomiya 662-8580, JAPAN

Telephone : 0798-65-2111

Fax : 0798-65-4200

Your Local Agent/Dealer

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SAFETY INSTRUCTIONS

Safety Instructions for the Operator



WARNING



ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel should work inside the equipment.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the switchboard if the equipment is emitting smoke or fire.

Continued use can cause fatal damage to the equipment. Contact a FURUNO agent for service.

Do not place liquid-filled containers on the top of the processor unit.

Fire or electrical shock may result if the liquid enters the equipment.

Use the proper fuse.

Use of a wrong fuse can damage the equipment and cause fire.



CAUTION

No one navigation device should ever be solely relied upon for the navigation of a vessel.

Always confirm position against all available aids to navigation (incl. nautical charts), for safety of vessel and crew.

Safety Instructions for the Installer



WARNING

Turn off the power at the switchboard before beginning the installation.

Fire or electrical shock can result if the power is left on.

Do not install the equipment where it may get wet from rain or water splash.

Water in the equipment can cause fire, electrical shock or damage to the equipment.

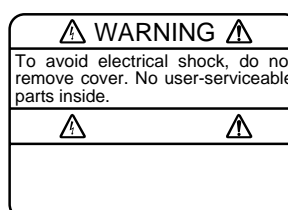
NOTICE

Observe the following compass safe distances to prevent interference to a magnetic compass:

	Standard Compass	Steering Compass
Display unit SC-502	0.4 m	0.3 m
Processor unit SC-501	0.9 m	0.6 m
Antenna unit SC-303	0.3 m	0.3 m
Antenna unit SC-603	0.3 m	0.3 m

WARNING LABEL

A warning label is attached to the processor unit. Do not remove the label. If the label is missing or damaged, contact a FURUNO agent or dealer about replacement.



WARNING LABEL

Name: Warning Label (1)
Type: 86-003-1011-1
Code No.: 100-236-231

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FOREWORD

A Word to the Owner of the SC-50

FURUNO Electric Company thanks you for purchasing the FURUNO SC-50 THD Satellite Compass. (Hereafter, for sake of brevity, we refer to the SC-50 as Satellite Compass.) We are confident you will discover why the FURUNO name has become synonymous with quality and reliability.

For over 50 years FURUNO Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your satellite compass is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the operation, installation and maintenance procedures set forth in this manual.

We would appreciate feedback from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO.

Features

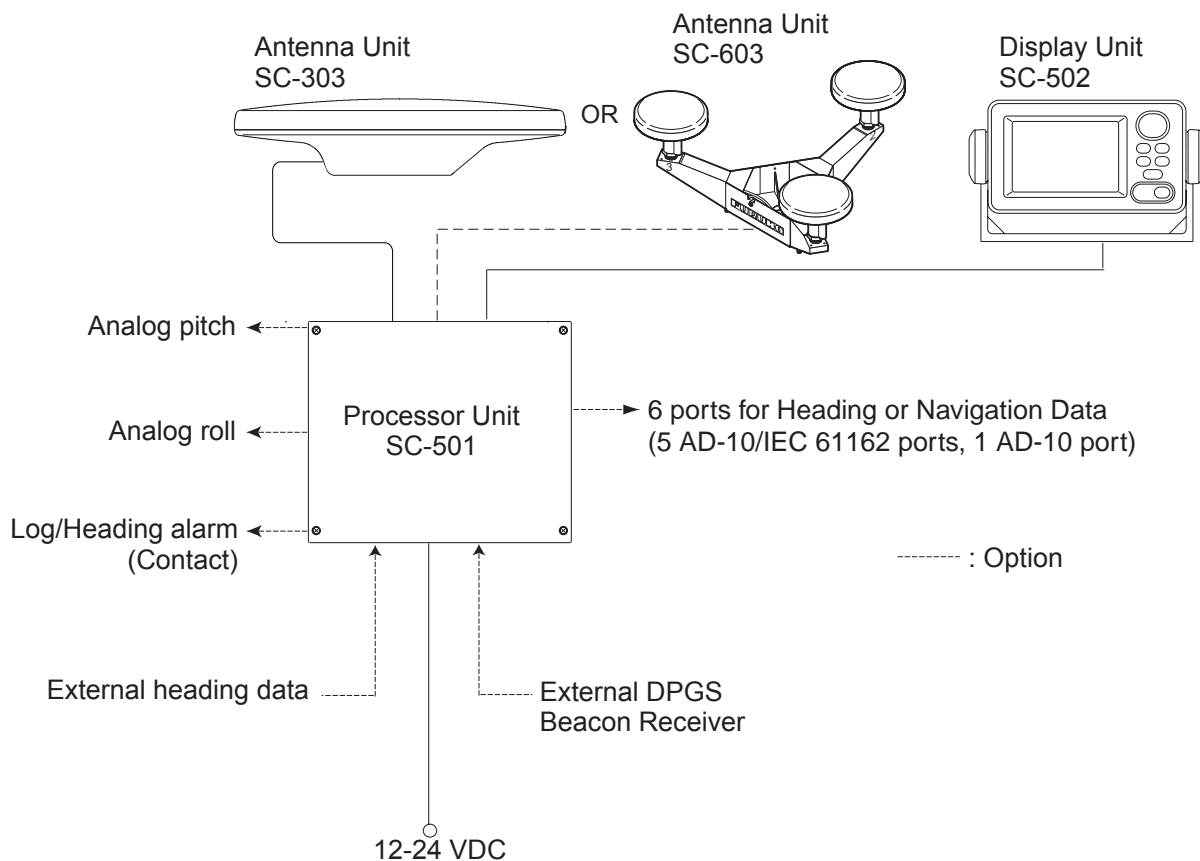
The SC-50 is a new satellite compass designed with FURUNO's advanced GPS kinematic technology. This compass finds a wide range of applications for any type of ships and mobile units at sea or on land.

The main features are

- Perfect for use as heading sensor for Radar/ARPA, AIS, ECDIS, scanning sonar
- There are no mechanical parts such as gimbals or rotating motor, thus the compass is free from routine maintenance
- The performance is not affected by geomagnetism thus it is suitable for use on any vessel
- No need for speed correction like a gyrocompass
- Short settling time - three minutes
- Meets the following requirements: IMO MSC. 116(73), ISO/FDIS 22090-3, IMO A. 694(17), IEC 60945 (2002-08), IEC 61162 (2000).

SYSTEM CONFIGURATION

The SC-50 consists of an antenna, a display unit and a processor unit. The tri-antenna system accommodates three antennas/receiver units and is available in a low-profile radome type or open type. The tri-antenna system helps reduce the influence of ship's motion (rolling).



Category of Units

Processor Unit: Protected from weather
 Display Unit: Protected from weather
 Antenna Unit: Exposed to weather

System configuration

This GPS receiver complies with Canadian standard RSS-210 (Low Power License-Exempt Radio communication Devices).
 Operation is subject to the following two conditions:
 (1) this device may not cause interference, and
 (2) this device must accept any interference, including interference that may cause undesired operation of the device.

EQUIPMENT LIST

Standard supply

Name	Type	Code No.	Qty	Remarks
GPS Antenna	SC-303	—	Choose one	Radome type
	SC-603	—		Open type
Display Unit	SC-502	—	1	
Processor Unit	SC-501	—	1	
Installation Materials	CP20-02230*	004-378-110	1	TPPX cable
	CP20-02260*	004-379-660		TNC cable
	CP20-02231*	004-378-050	1	For SC-303
	CP20-02600	000-041-905	1	For processor unit: CP20-02601*, MJ-A7SPF0006-100
	CP20-02203*	004-380-660	1	For display unit: Tapping screw (5X20 4 pcs.)
	CP20-02201*	004-377-570	1	Antenna base for SC-603
	CP20-02202*	004-377-590	1	For SC-603
Spare Parts	SP20-01101*	004-379-720	1	For processor unit

Optional supply

Name	Type	Code No.	Qty	Remarks	
Antenna Cable Set	CP20-01700	004-372-110	1	30 m	3 sets required
	CP20-01710	004-372-120		50 m	
Cable Assy.	TPPX6-3D2V-15M	000-143-559	1	Antenna cable	
Flush Mount F	OP20-29*	000-041-405	1	For display unit	
Flush Mount S	OP20-17*	000-040-720	1	For display unit	
Bird-repellent fixture	OP20-35	004-380-820	1	For SC-303, 9 pcs.	
	OP20-36	004-380-830	1	For SC-603, 4 pcs.	
	OP20-37	004-380-840	1	For SC-603, 1 pc.	

* See packing list at back of manual.

THD SPECIFICATIONS OF THD SATELLITE COMPASS SC-50

1 GENERAL

- | | | |
|------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.1 | Heading Accuracy | $\pm 1.0^\circ$ (95%) |
| 1.2 | Heading Resolution | 0.1° |
| 1.3 | Follow-up | $45^\circ/\text{s}$ rate-of-turn |
| 1.4 | Settling Time | 3 minutes |
| 1.5 | Position Accuracy | 10 m, or 5 m (DGPS), 95% of the time |
| 1.6 | Heading/Nav Data Output | <p>AD-10 format: 1 port (specialty port)</p> <p>AD-10 format 5 ports or IEC 61162 format 10 ports
(selectable on menu)</p> <p>IEC 61162 format is RS-485 level</p> <p>Sentence: HDT, HDM, ROT, ATT, VDR, VTG, GGA, GNS
GLL, VHW, VBW, HVE, ZDA</p> |
| 1.7 | Log Signal Output | 1 port, log pulse (pulse signal) |
| 1.8 | Heading Alarm Output | 1 port, alarm output (contact signal) |
| 1.9 | Motion Output Signal | 1 port pitch, 1 port roll |
| 1.10 | External Heading Input | <p>1 port AD-10 or IEC61162 format (auto recognition)</p> <p>AD-10: backup heading</p> <p>IEC 61162: water tracking speed input (sentence: HDT, HDG,
HDM, VBW, VHW, VLW)</p> |
| 1.11 | External Beacon Input | 1 port, RTCM SC-104 format (RS-232 level) |

2 DISPLAY UNIT

- | | | |
|-----|----------------|----------------------------------------------------------------------------|
| 2.1 | Display Type | 4.5 inch monochrome LCD, 120 x 64 dots |
| 2.2 | Effective Area | 60 mm (H) x 95 mm (W) |
| 2.3 | Contrast | 64 levels |
| 2.4 | Display Mode | Heading, Nav data, Steering, Compass rose, Rate of turn and
Speed modes |

3 POWER SUPPLY

12-24 VDC: 1.2-0.5 A

4 ENVIRONMENTAL CONDITIONS AND EMC

- | | | |
|-----|------------------------|--------------------------------------------------------------------------|
| 4.1 | Ambient Temperature | |
| | Display/Processor Unit | -15°C to $+55^\circ\text{C}$, Designed for protected area |
| | Antenna Unit | -25°C to $+70^\circ\text{C}$, Designed for exposed area |
| 4.2 | Humidity | $93\% \pm 3\%$ at 40°C |

- 4.3 Waterproofing
 - Antenna Unit IPX6
 - Display Unit IPX5
 - Processor Unit IPX0
- 4.4 Vibration IEC 60945

5 COATING COLOR

- 5.1 Display/Processor Unit
 - Panel: N3.0 Newtone No.5 (dark gray)
 - Chassis: 2.5GY5/1.5 (light gray)
- 5.2 Antenna Unit
 - N9.5 (white)

1 INSTALLATION

1.1 Mounting Considerations

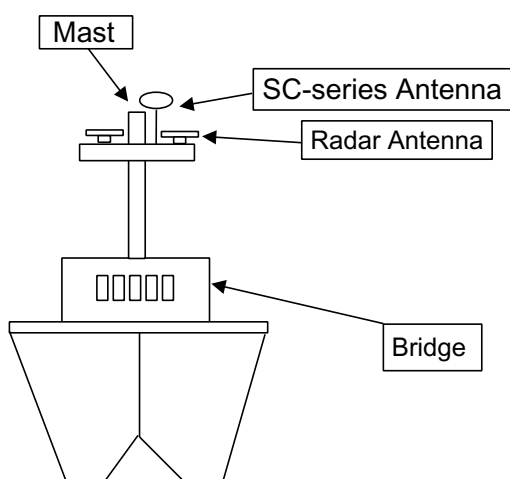
1.1.1 Antenna unit

General

- Keep the length of the antenna cable in mind when selecting a mounting location.

Installing the antenna above superstructures

- The antenna must be mounted above all other structures on the vessel to obtain an unobstructed view of the satellites regardless of vessel heading. Failure to do so will cause shadows and multipath reflection problems.



Example of antenna installed above all superstructures

Installing the antenna below superstructures

If it is not possible to mount the antenna above all superstructures on the vessel, as shown in the illustration above, shading and multipath problems may occur on at least one heading, and possibly more. To possibly avoid those problems, observe the guidelines in this section.

NOTICE

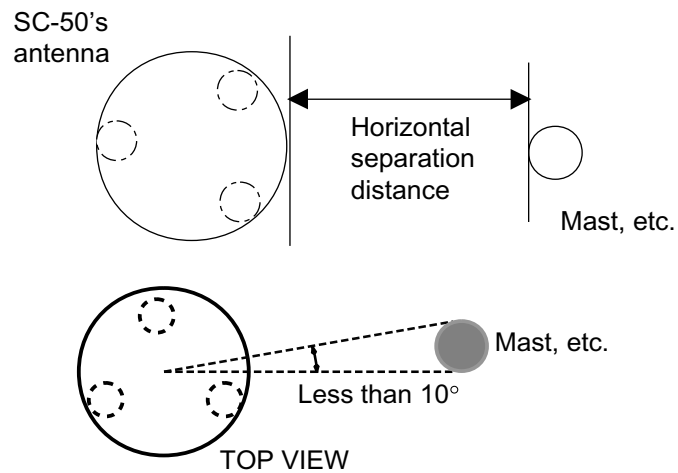
If the antenna is installed below any superstructure, the installation must be done over a two-day period, following the procedure in the service manual.

At least 12 hours are required to capture tracking data to measure multipath indexes and locate areas of shading.

1. INSTALLATION

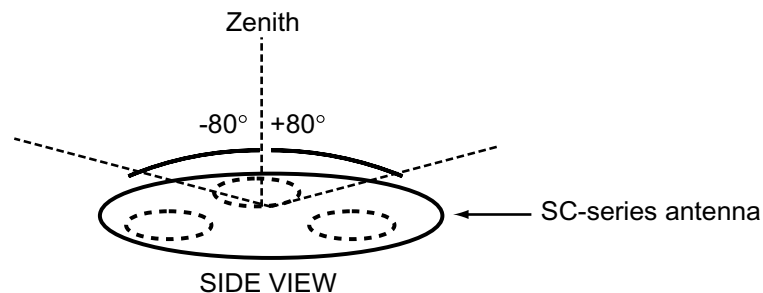
- The horizontal separation between the antenna and masts must be as follows:

Mast diameter	Separation distance (minimum)
10 cm	1.5 m
30 cm	3 m



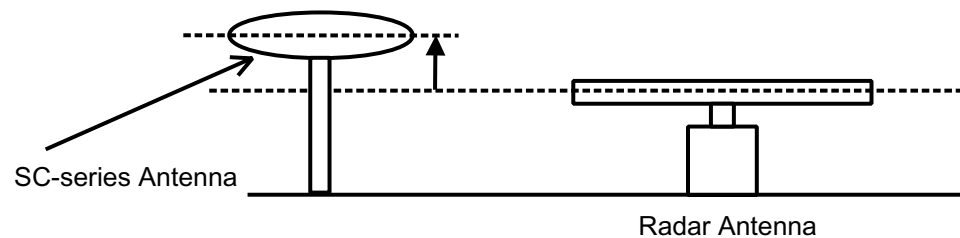
Horizontal separation between antenna and masts

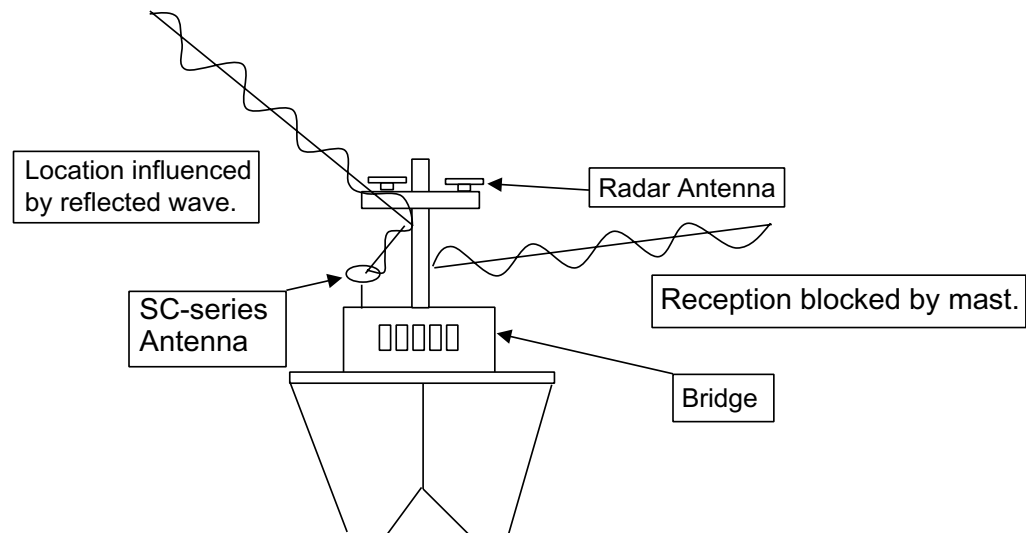
- The field of view above the antenna should be as shown below, $\pm 80^\circ$ against zenith. To avoid reflections from masts and the like, locate the antenna well away from the shadows of the radar mast, etc.



Antenna and field of view

- Locate the antenna unit above the radar antenna, out of the radar beam.





Example of antenna installed below superstructures

1.1.2 Display unit, processor unit

- Choose a location where vibration and shock are minimal.
- Install the units well away from locations subject to rain and water splash.
- Locate the units away from air conditioner vents.
- Keep the units out of direct sunlight because of heat that can build up inside their cabinets.
- Choose a well-ventilated location.
- For the display unit, choose a location where it can be easily operated.
- Leave sufficient space around the units to permit access for maintenance. See the outline drawing for recommended maintenance space.

1.2 Installing the Antenna Unit

1.2.1 Antenna unit SC-303

Note: “Bird-repellent fixtures” (supplied) may be attached to the antenna cover to prevent birds from alighting on the cover. If it is more convenient to attach them before fixing the antenna unit to the mounting location, do step 9 before fixing the antenna unit.

NOTICE

Fasten the antenna to the mounting location lastly if it is more convenient to connect the antenna cable before mounting the antenna unit.

1. Prepare a mounting platform (wood, steel or aluminum) in accordance with the illustration shown below. If corrosive material is used, take necessary anti-corrosion measures.

Note: When drilling holes in the platform, be sure they are parallel with the fore-and-aft line.

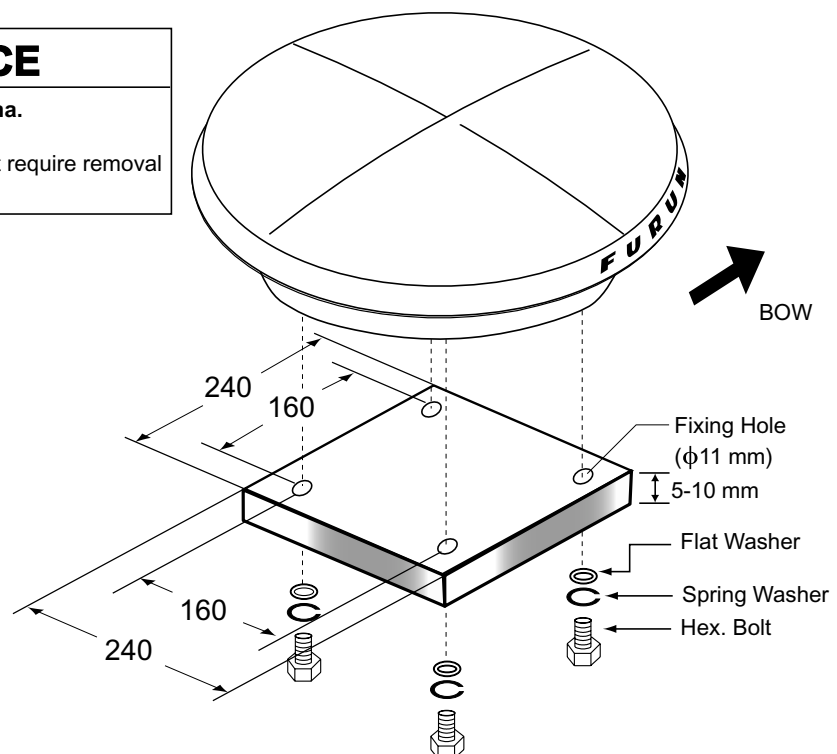
2. Orient the unit so the two lines on the base is facing the bow and then fasten the antenna unit to the platform with four sets of M10 hex. bolts, spring washers and flat washers. (The installation error should be within $\pm 2.5^\circ$.) The torque for the hex. bolts should be between ± 20 2Nm.



NOTICE

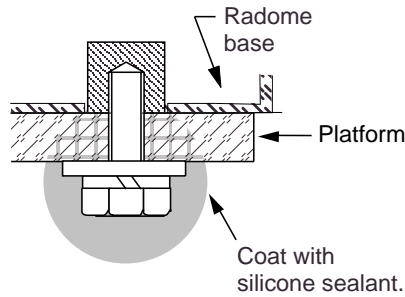
Do not open the antenna.

This installation does not require removal of the antenna cover.



Mounting dimensions for antenna, orienting the antenna

3. Coat exposed parts of nuts, bolts and washers with silicone sealant.



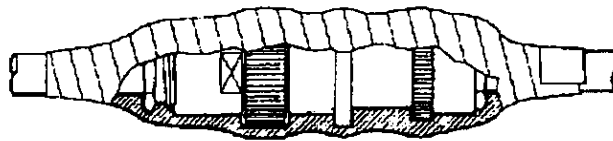
Coating bolt, nut and washers with silicone sealant

4. Connect the three coaxial cables coming from the antenna unit to the appropriate coaxial cables on the antenna cable, referring to the table below.

Cable from antenna (no. marked on cable)	Cable TTPX6-3D2V-15M
ANT 1	No color
ANT 2	Yellow
ANT 3	Red

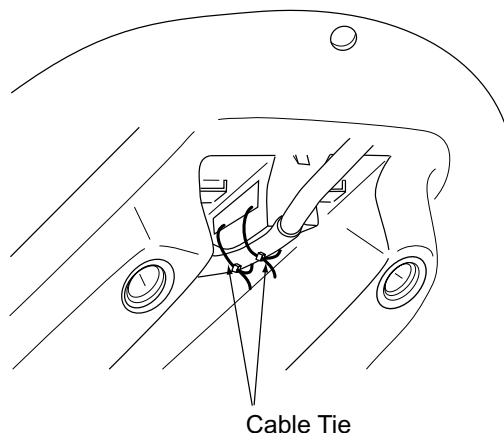
For TNC-PS-3D-15, cable labels are provided from cable 1, 2 and 3 to differentiate between them.

5. Cover the antenna connectors with vulcanizing tape and vinyl tape, for waterproofing. Tie tape ends with a cable tie.



Waterproofing the antenna connector

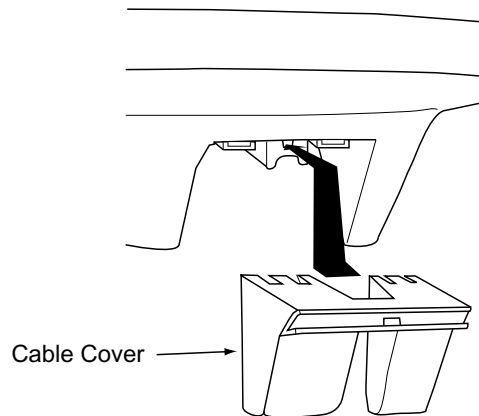
6. Set the joints of the coaxial cables into the cavity in the antenna base.
7. Pass two cable ties (long life, temperature resistant type, local supply) through the hole shown in the figure below. Fasten them at the locations shown in the figure below.



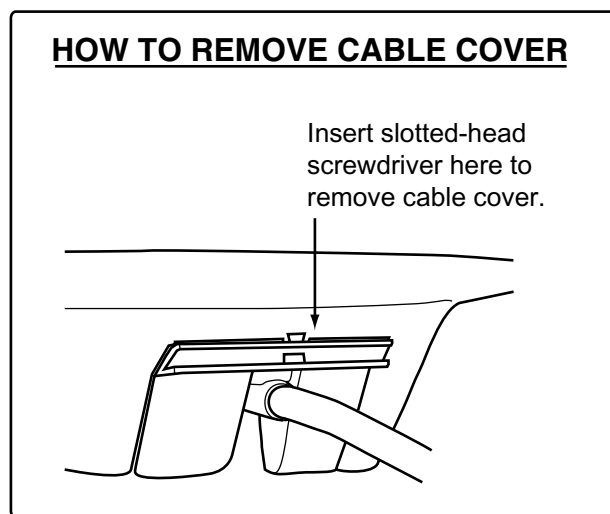
How to fasten the antenna cable

1. INSTALLATION

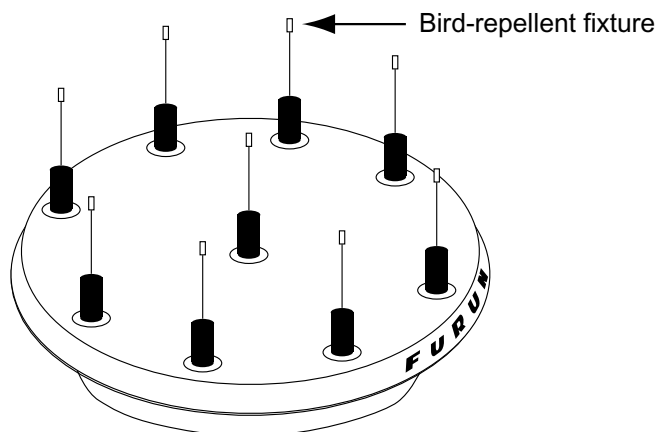
8. Set the “cable cover” to the antenna base as shown in the figure below.



How to insert the cable cover



9. If necessary, attach nine “bird-repellent fixtures” (supplied) to the antenna cover as shown below. Use the paper pattern to position the fixtures.



Antenna unit

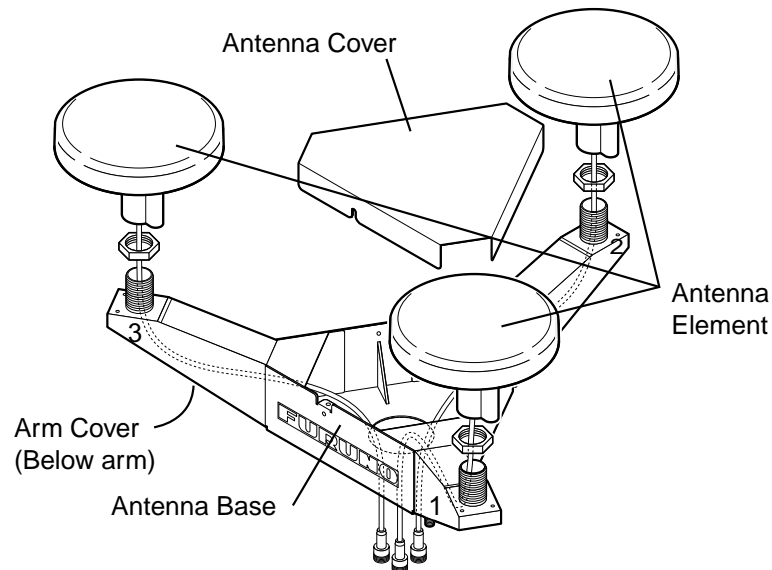
10. Follow paragraph 1.6 to set up the equipment. If the status display shows “OK” the installation is suitable. If OK is not displayed, relocate the antenna.

1.2.2 Antenna unit SC-603

Note: “Bird-repellent fixtures” (supplied) may be attached to each antenna element and the Antenna Cover to prevent birds from alighting on the antenna. If it is more convenient to attach them before fixing the antenna unit to the mounting location, do step 10 in “Welding the antenna unit” before fixing the antenna unit.

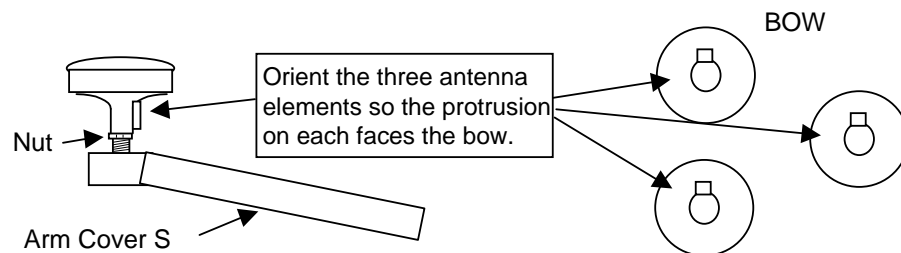
Mounting

1. Screw in three antenna elements in the Antenna Base. Remove Antenna Cover and Arm Cover.



Antenna unit SC-603

2. Pass the coaxial cable from each antenna element through the center of the respective arm and then through the hole at the center of the antenna unit.
3. Orient the three antenna elements so that the protrusion on each faces the bow.



How to orient the antenna elements

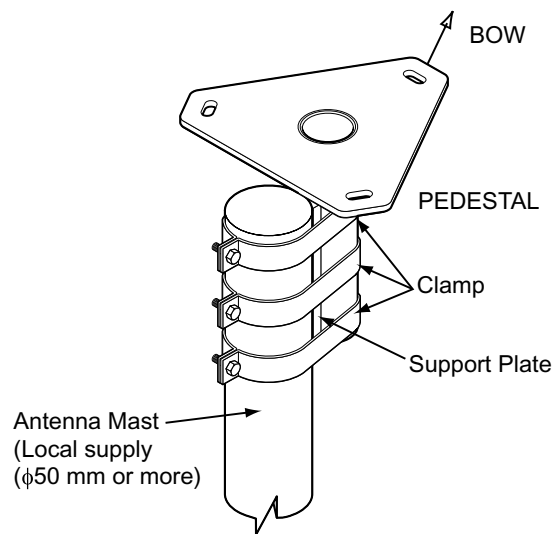
1. INSTALLATION

4. Making sure each antenna element is correctly oriented, fix each with its nut. Write the corresponding arm number on each coaxial cable, using a magic marker. (When connecting with the coaxial cables from the processor unit it is necessary to match correct antenna element number with coaxial cable color.)

Arm [1]	1
Arm [2]	2
Arm [3]	3

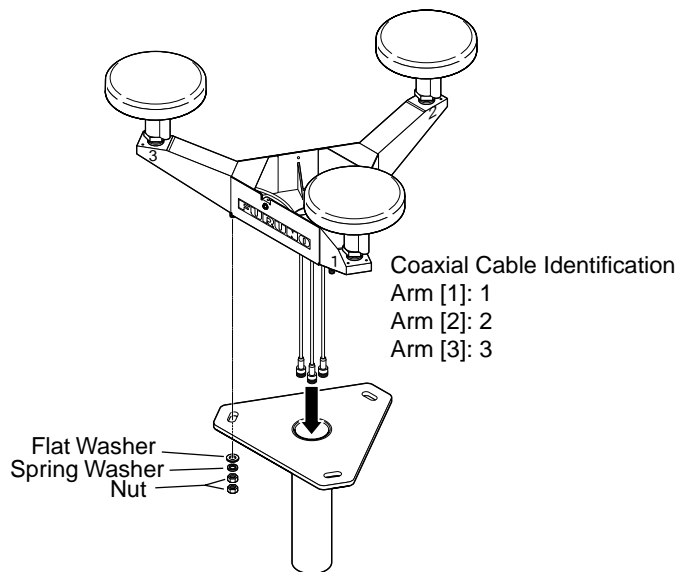
5. Temporarily fix the pedestal and support plate to the antenna mast as shown in the illustration below. (The pedestal and support plate will be welded to the antenna mast after confirming that the installation site is suitable, following paragraph 2.6.)

Note: If U-bolts are used to temporarily fix the pedestal and support plate, DO NOT overtighten them – overtightening may deform the pedestal.



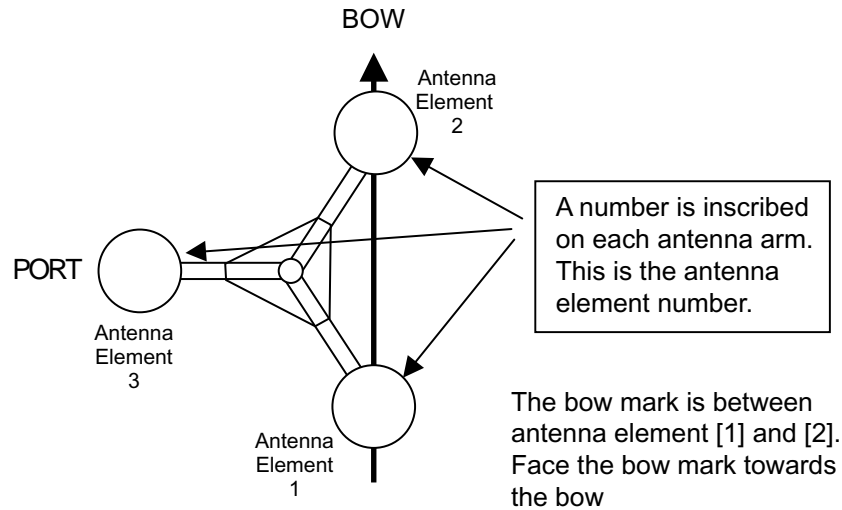
How to temporarily fix the support plate and pedestal to the antenna mast

6. Set the antenna unit to the pedestal.



Fixing antenna unit to pedestal

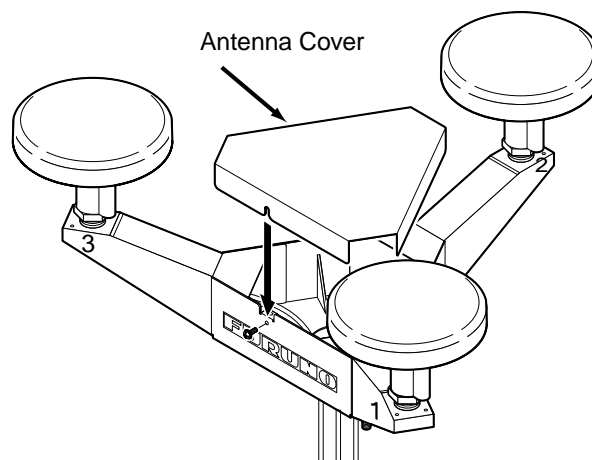
7. Orient the antenna unit as shown in the illustration below.



Orienting the antenna unit (top view)

NOTICE
The antenna unit should be positioned within $\pm 2.5^\circ$ of the bow.

8. Fasten the Antenna Cover with three screws.



Antenna unit SC-603

9. Follow the instructions in the paragraph 2.6. If the satellite tracking status display shows "OK," the installation site is suitable. Weld the antenna unit to the antenna mast as shown in the next paragraph.

1. INSTALLATION

Welding the antenna unit

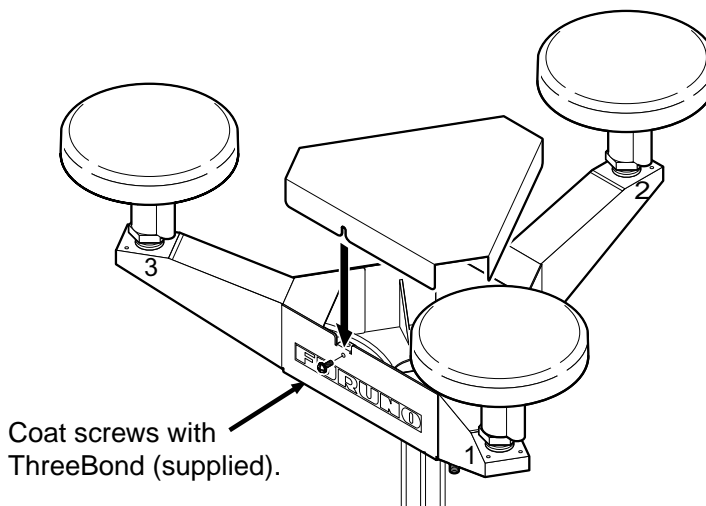
The antenna unit may be welded to the antenna mast if the satellite status display shows "OK."

1. Unfasten the coaxial cables and dismount the antenna unit.
2. Weld the pedestal and support plate to the antenna mast. Remove the clamps used to temporarily fasten the pedestal and support plate.
3. Fasten the coaxial cables and fix the antenna unit.
4. Wrap the antenna connector with self-vulcanizing tape and then vinyl tape for waterproofing as shown in the illustration below. Tie tape ends with cable ties to prevent unraveling.



Waterproofing the antenna connector

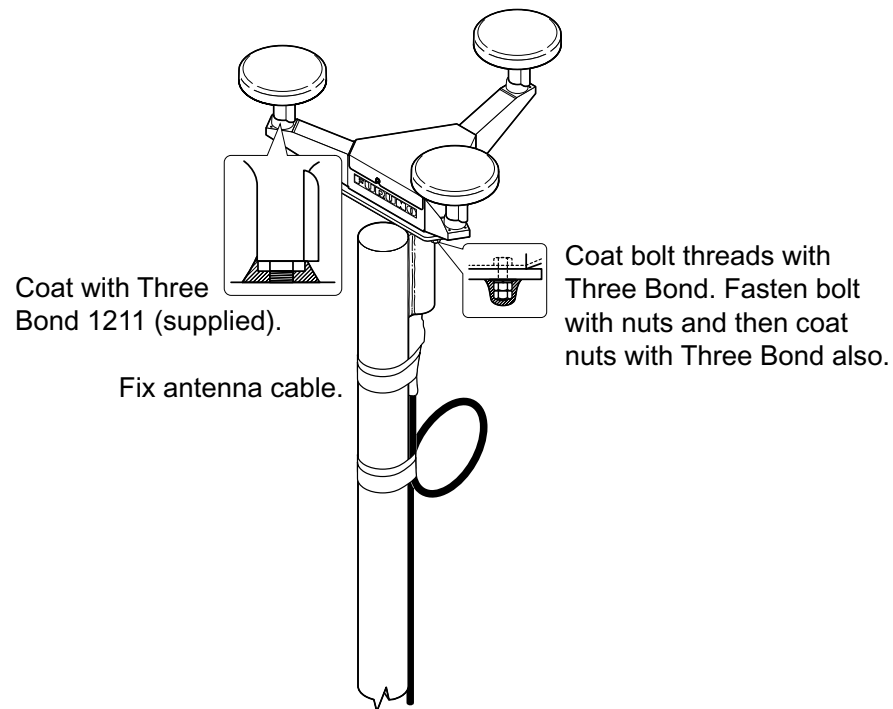
5. Coat the three screws fixing the Antenna Cover S with Three Bond 1211 (supplied).



Antenna unit SC-603

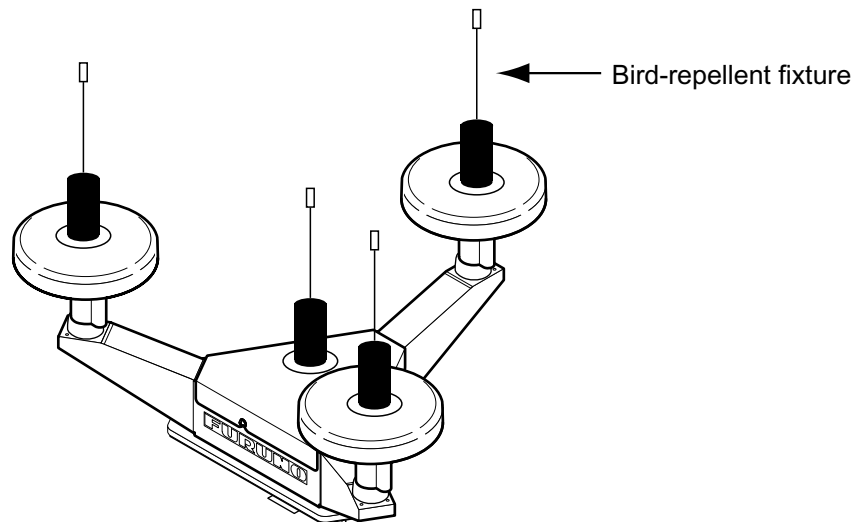
6. Look at the heading indication on the display. If the heading error is between 5° and 10°, loosen the nut at the center of the antenna unit and adjust antenna orientation, while watching the heading indication on the display.

7. Make a loop in the antenna cable as shown in the illustration below. Fasten the antenna cable to the antenna mast with cable ties.



Fastening the antenna cable

8. Coat bolt threads and nuts at the bottom of each antenna element with Three Bond 1211.
9. Paint pedestal and support plate with anti-corrosive paint.
10. If necessary, attach the “bird-repellent fixtures” (supplied) to each antenna element and the Antenna Cover S as shown below.



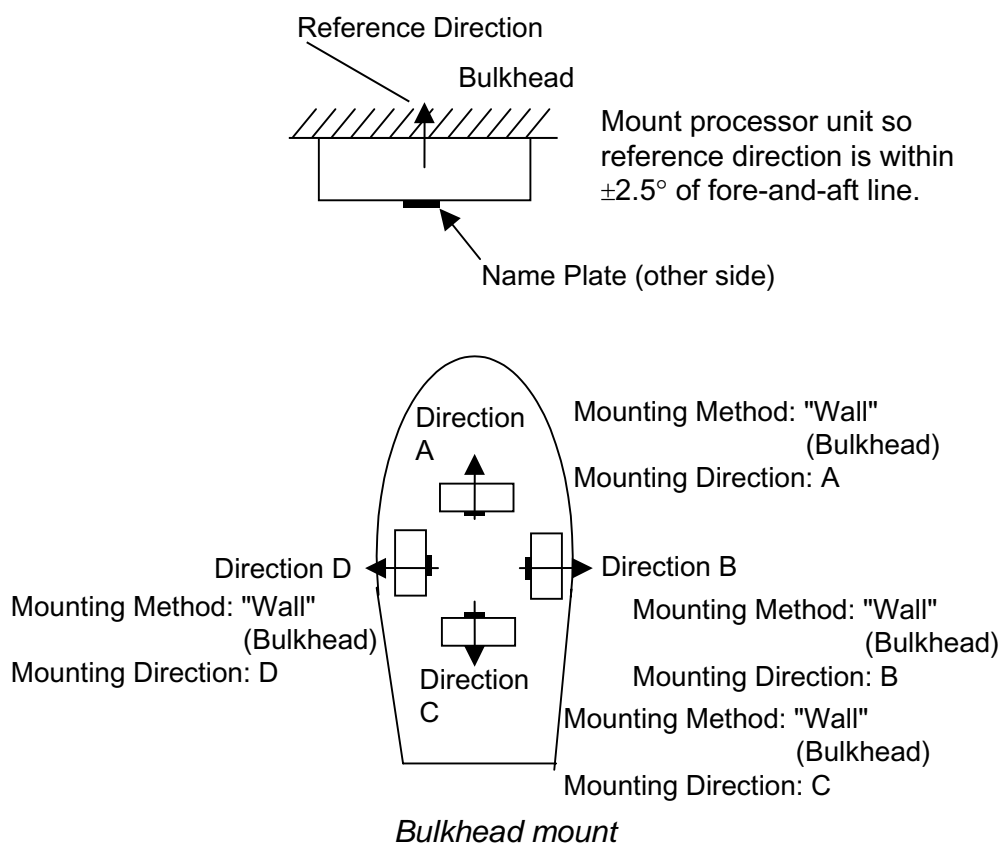
Antenna element

1.3 Installing the Processor Unit

The processor unit should be mounted aligned with the ship's fore-and-aft line. It can be mounted on the deck, bulkhead, or on the underside of a desk. Choose a mounting location which allows you to easily view the power lamp on the top of the unit and which is within $\pm 2.5^\circ$ of the ship's fore-and-aft line.

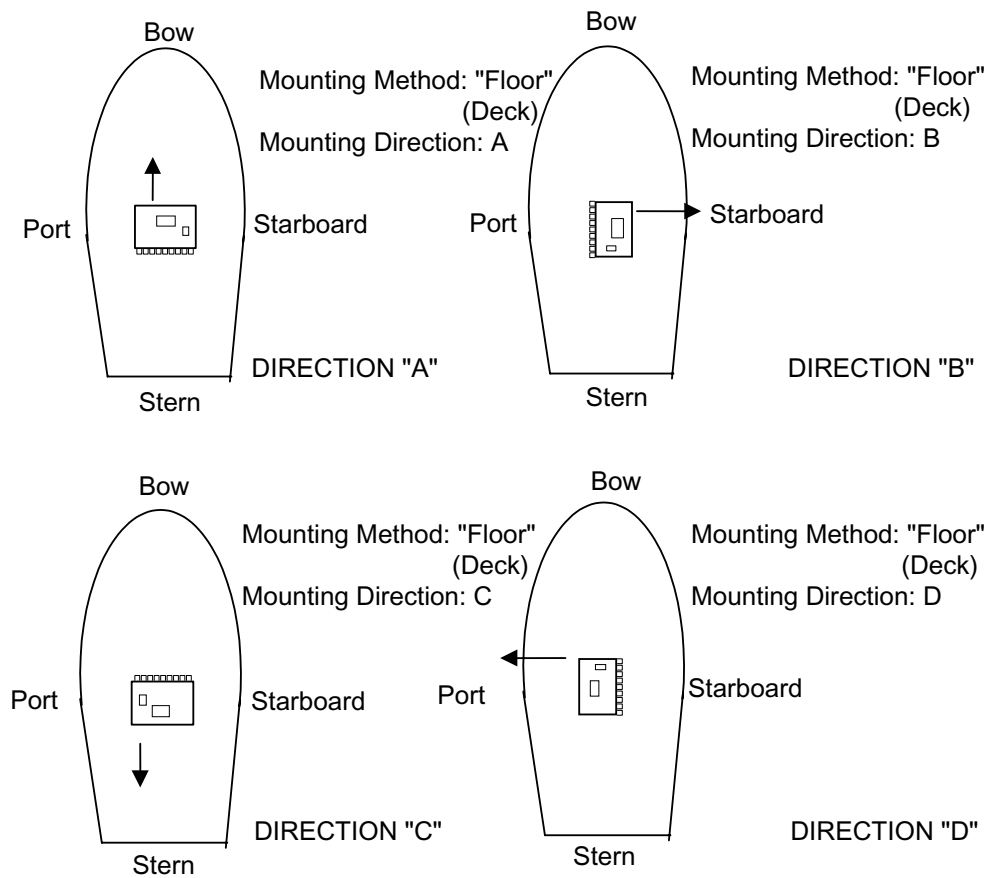
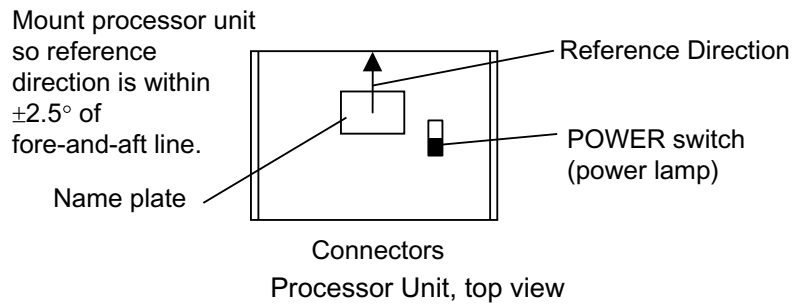
1.3.1 Bulkhead mount

The processor unit is shipped from the factory ready for bulkhead mounting. Orient the processor unit as shown below and fix it to the mounting location with four tapping screws (M5x20). You will set the orientation later on the menu.



1.3.2 Deck mount

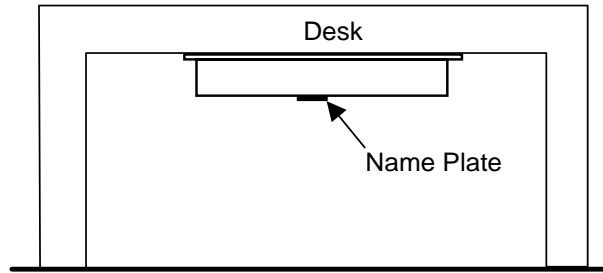
Orient the processor unit as shown below and fix it to the mounting location with four tapping screws (M5x20). You will set the orientation later on the menu.



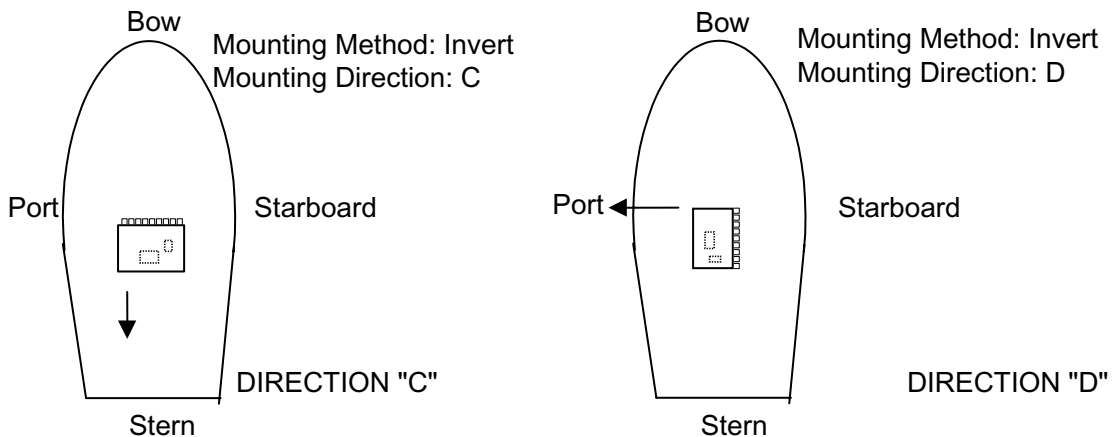
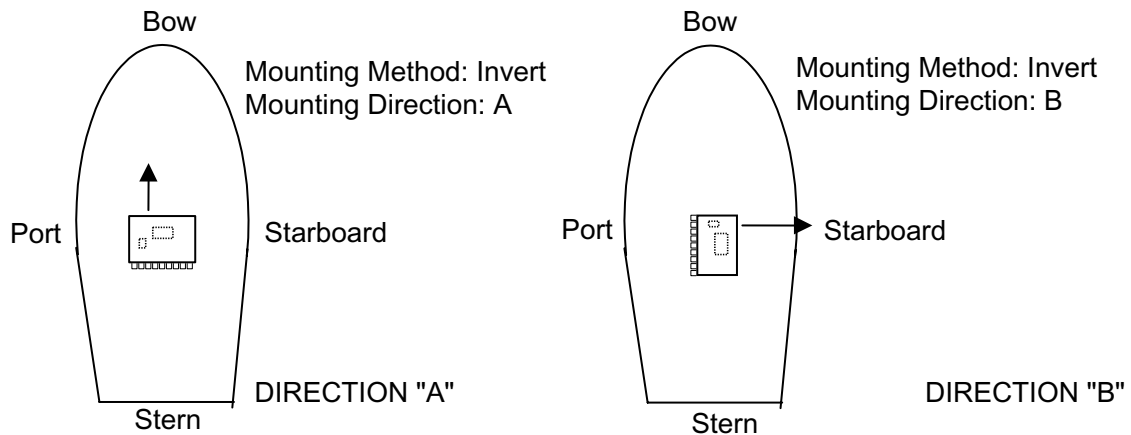
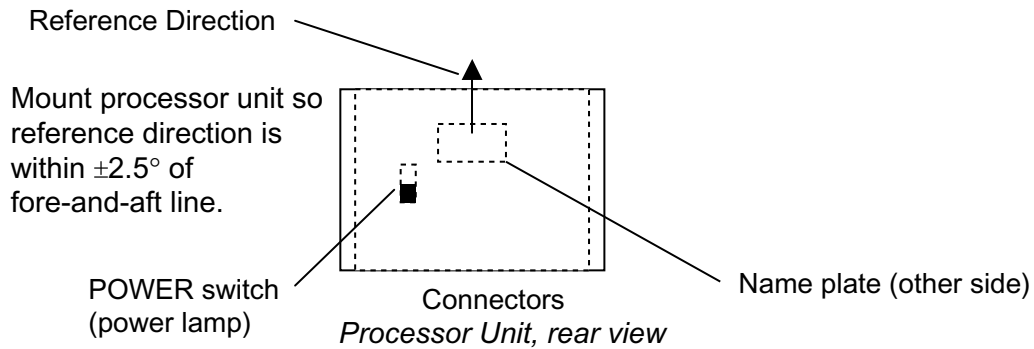
Processor unit orientation, deck mounting

1.3.3 Installation on the underside of a desk

The processor unit may be mounted on the underside of a desk as shown in the figure below. **Do not install it on the overhead.**



Installation of processor unit on the underside of a desk

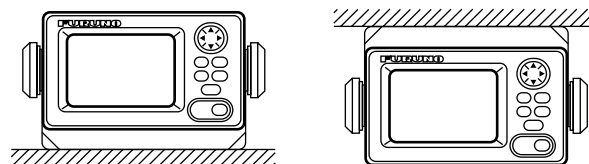


Mounting on underside of desk

1.4 Installing the Display Unit

1.4.1 Desktop, overhead mounting

1. Fasten the hanger to the mounting location with four tapping screws (supplied). See the outline drawing for mounting dimensions.
2. Screw the knobs into the display unit.
3. Set display unit to the hanger and tighten the knobs.
4. Run the ground wire between the ground terminal on the display unit and the ship's superstructure.



Desktop

Overhead

Display unit mounting methods

1.4.2 Flush mount

Two types of flush mounts are available. See the outline drawing at the back of the manual for details.

Flush mount “F”

Flush mount “F” kit Type: OP20-29, Code No: 000-041-405)

Name	Type	Code No.	Qty
Cosmetic Panel	20-016-1051	100-251-370	1
Tapping Screw	5X20	000-802-840	4
Hex Bolt	M6X12	000-862-127	2
Spring Washer	M6	000-864-260	2

1. Make a cutout in the mounting location. The dimensions are 183(W) x 92(H) mm.
2. Fasten the cosmetic panel to the display unit with hex bolts and spring washers.
3. Fasten the display unit to the mounting location with tapping screws.

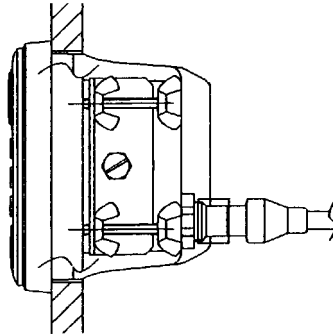
1. INSTALLATION

Flush mount “S”

Flush mount “S” kit Type: OP20-17, Code No.: 000-040-720)

Name	Type	Code No.	Qty
Flush Mount Fixture	20-007-2401	100-183-190	2
Wing Bolt	M4X30	000-804-799	4
Wing Nut	M4	000-863-306	4
Hex Bolt	M6X12	000-862-127	2
Spring Washer	M6	000-864-260	2

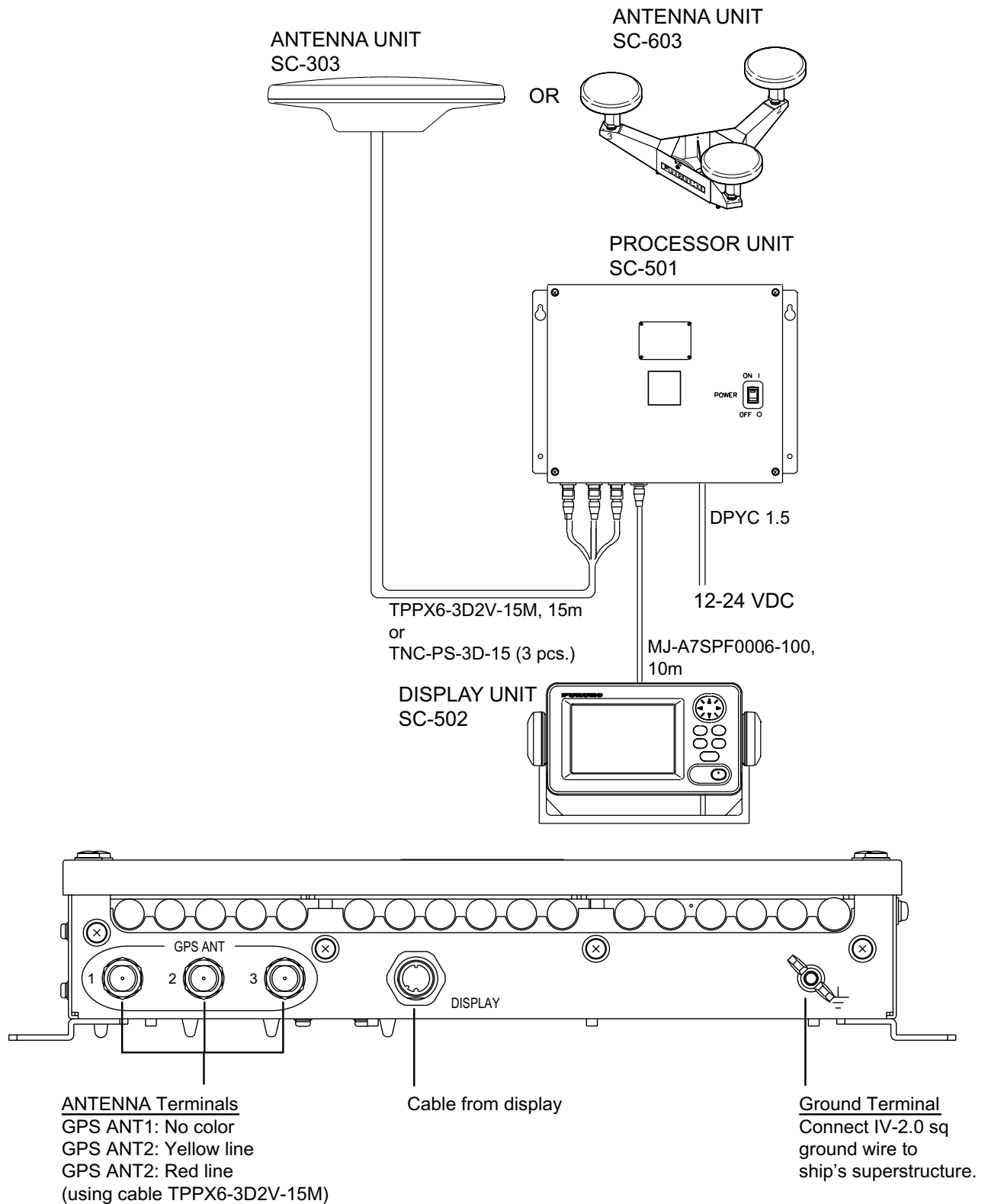
1. Make a cutout in the mounting location. The dimensions are 167(W) x 92(H) mm.
2. Place the display unit in the cutout.
3. Fix the display unit to the two flush mount fixtures with hex bolts and spring washers.
4. Screw the butterfly nut on the butterfly bolt.
5. Fix the display unit with the butterfly bolt and then tighten the butterfly nut.



Flush mount “S”

1.5 Wiring

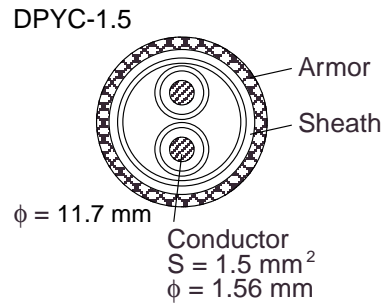
This section covers general wiring. For further details see the interconnection diagram at the back of this manual.



Wiring

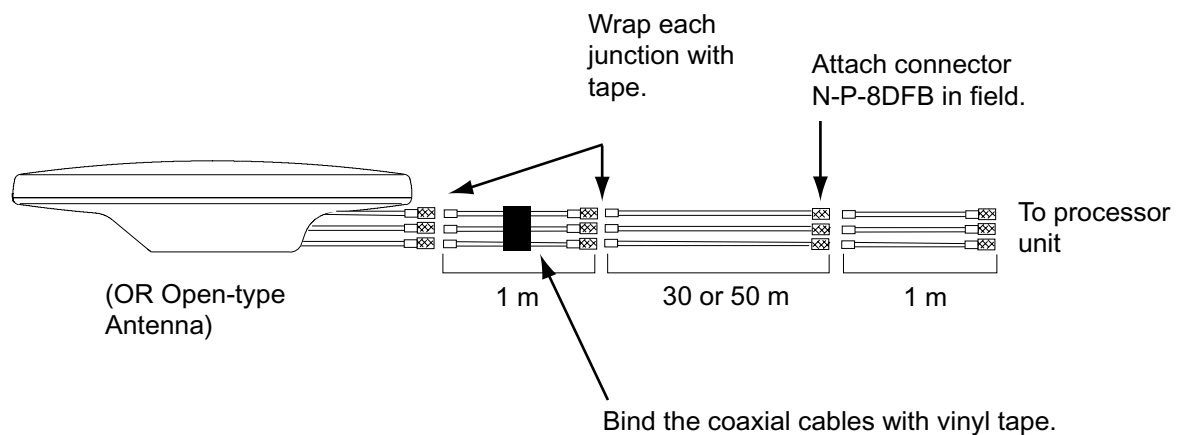
1. INSTALLATION

Note 1: Use cable type DPYC-1.5 (or equivalent) for the power cable.

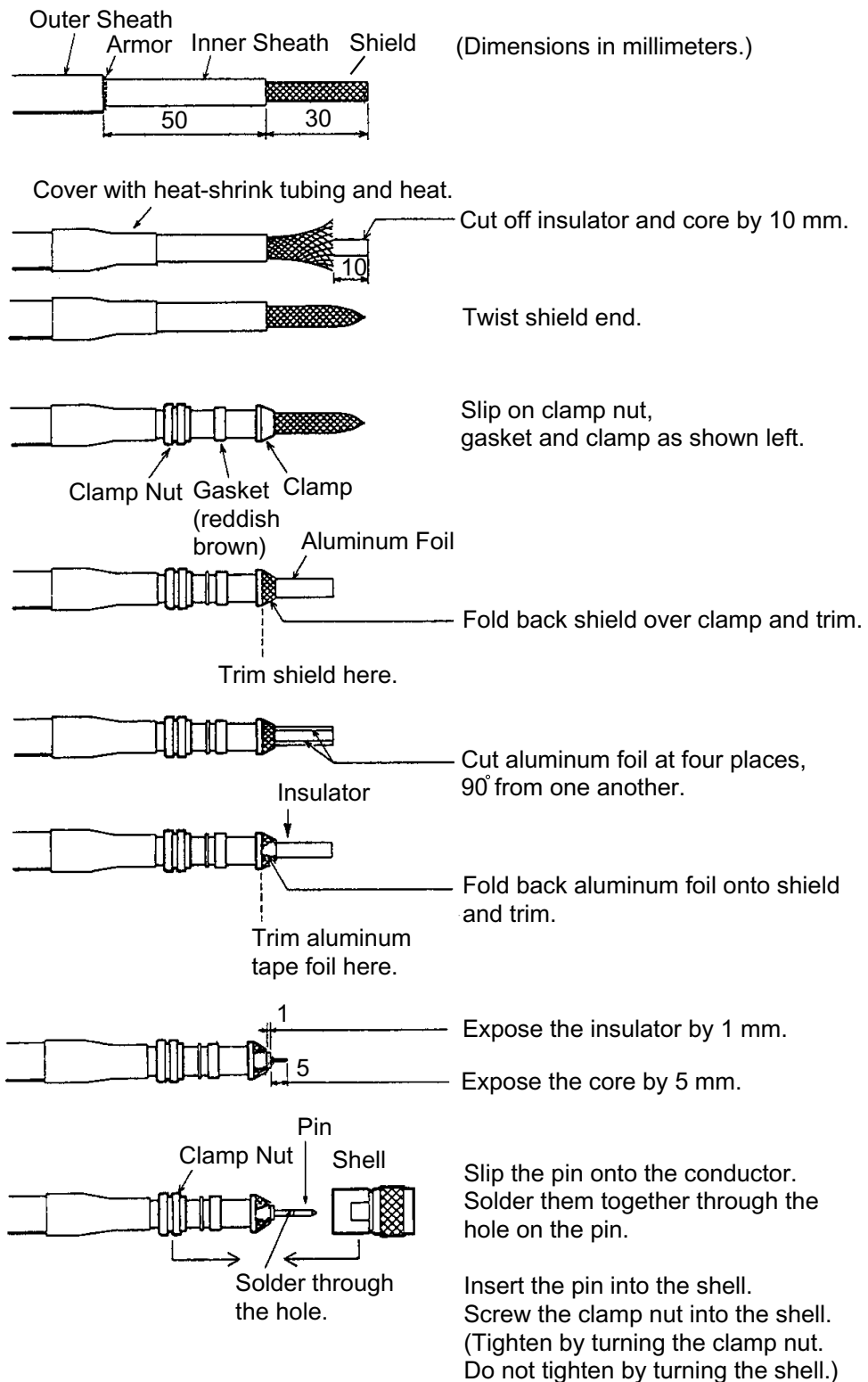


Sectional view of coaxial cable DPYC-1.5

Note 2: The optional antenna cable set (CP20-01700 or CP20-01710) allows you to extend antenna cable length to 30 m (50 m). See next page for how to attach the connector.



How to install the optional antenna cable set

How to attach connector N-P-8DFB

How to attach connector N-P-8DFB

1.6 Initial Settings

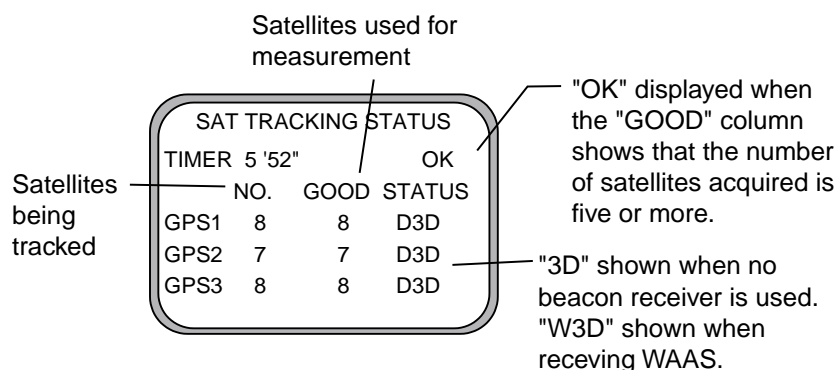
Follow the procedures in this section to enter initial settings.

NOTICE

Improper menu settings may stop output of data and display the message "RATE ERROR." Be sure to enter correct data.

1.6.1 Confirming satellite status

Press the [SAT STATUS] key.



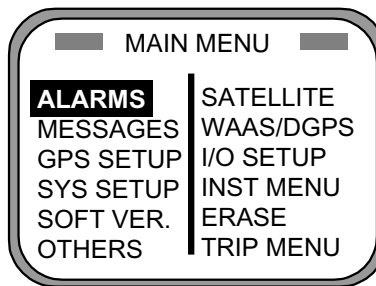
Satellite tracking status display

When the system is turned on for the first time it is in the "cold-start" state, which means there is no satellite data (almanac data) stored. In this condition it takes about 12 minutes to find heading. When heading is found the display shows "OK." The timer at the top left corner of the screen shows time since power on. If OK is not displayed within 30 minutes after turning on the power, the antenna mounting location may not be suitable. Suspect that the number of satellites in view is less than five due to signal blockage. (For the open-type antenna, loosen the nut at the center of the antenna unit to adjust antenna orientation.) Resolve the problem and then recheck tracking status.

If the heading error is between 5° and 10°, adjust orientation of the antenna unit, while watching the heading indication on the display.

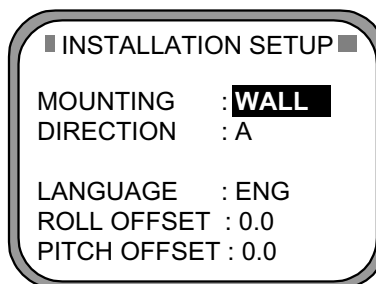
1.6.2 Choosing mounting method

1. Turn on the processor unit and then press the [MENU] key to show the menu.



Main menu

2. Use the Omnipad (⊙) to choose "INST MENU" and then press the [ENT] key.



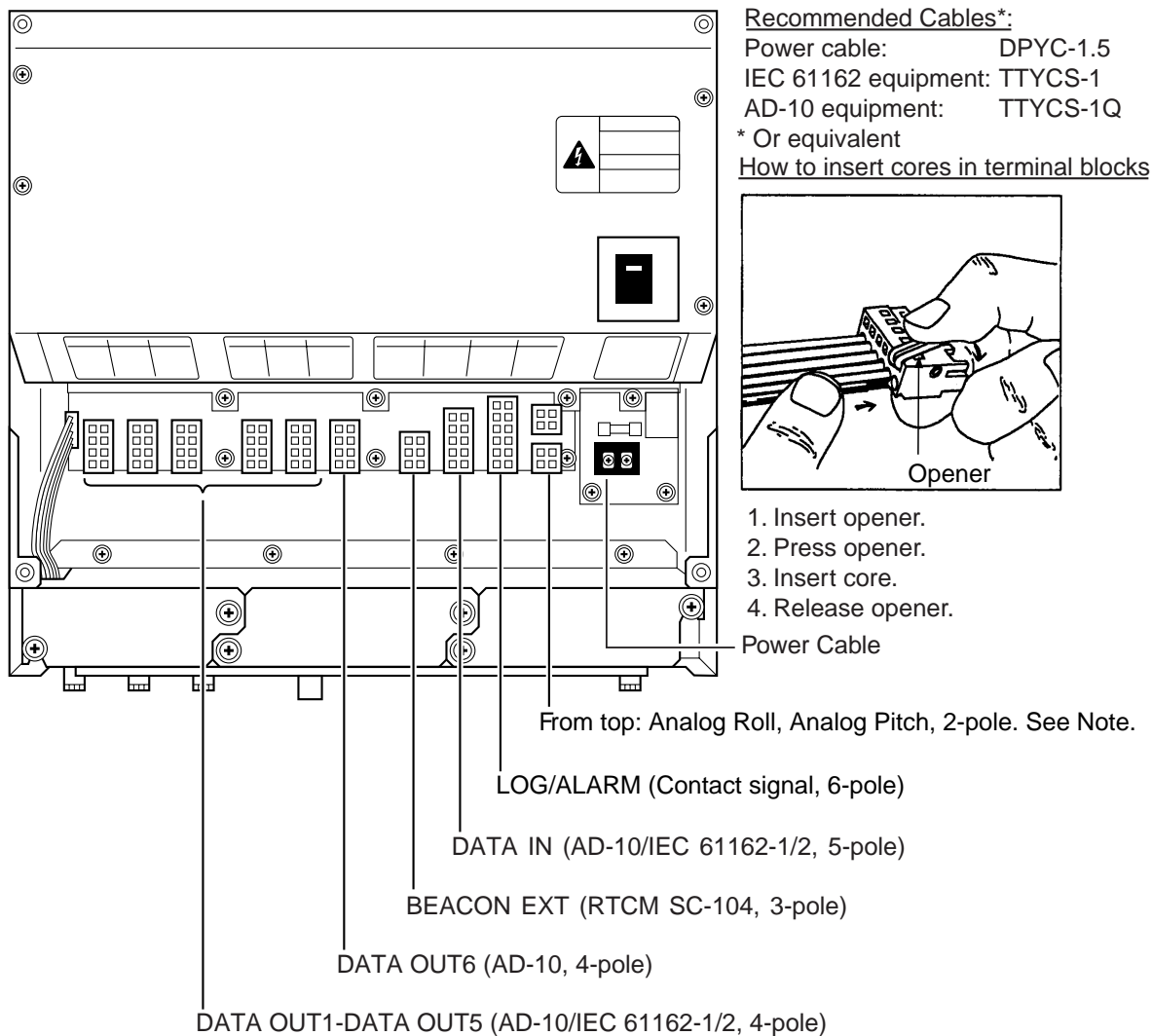
Installation setup menu

3. "MOUNTING" is selected; press the [ENT] key.
4. Use the Omnipad to choose the mounting method: "FLOOR", "WALL" or "INVERT" as appropriate.
5. Press the [ENT] key.
6. "DIRECTION" is selected; press the [ENT] key.
7. Use the Omnipad to choose mounting direction ("A", "B", "C" or "D") as appropriate. Refer to section 1.3.
8. Press the [ENT] key.

1.7 Connection of External Equipment

1.7.1 General wiring

All external equipment are terminated on the MAIN Board inside the processor unit. Turn off the power and unfasten four screws to remove the cover. Connect wiring from external equipment referring to the interconnection diagram. Use the terminal opener supplied to open terminal blocks, referring to the instructions below.



Processor unit, cover opened

Note 1: Attach labels (supplied) to cables to differentiate between them.

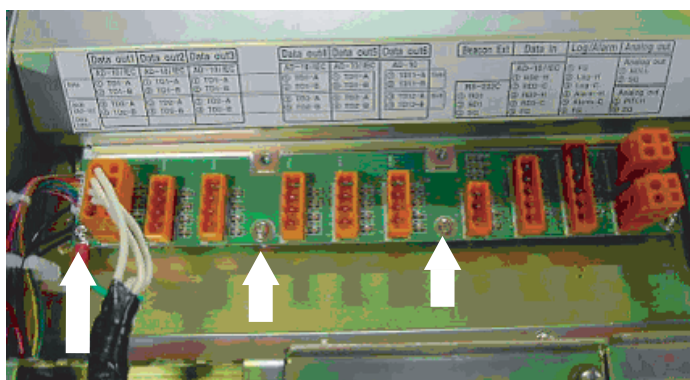
Note 2: A plastic sheet is placed across the cable glands of the processor unit to keep out foreign material. Cut out holes in the plastic where cables are to be lead in.

Note 3: Roll, pitch analog out voltage [V] = $0.0785 \times \theta$ (deg.) + 3.5 (θ = roll, pitch angle)
Output example

Roll or pitch angle	Analog out voltage
0 [deg]	3.5 [V]
5 [deg]	3.8925 [V]
10 [deg]	4.285 [V]
20 [deg]	5.07 [V]

1.7.2 Fabrication of cables

Cable	Sectional view, fabrication
Power cable DPCY-1.5 (or equivalent)	<p>SECTIONAL VIEW</p> <p>FABRICATION</p>
Cable for IEC 61162 format equipment (JIS cable TTYCS-1 or equivalent)	<p>SECTIONAL VIEW (TTYCS-1)</p> <p>FABRICATION</p>
Cable for AD-10 format equipment ((JIS cable TTYCS-1Q or equivalent)	<p>SECTIONAL VIEW (TTYCS-1Q)</p> <p>FABRICATION</p>



NOTE ON WIRING

- 1) Ground both this unit and external equipment.

- 2) Fabricate braided shield of external equipment as follows:
 - IEC 61162-1 input, AD-10 input (photo coupler): Connect to FG(frame ground).
 - IEC 61162-2 input (RS-422/485): Connect to SG(signal ground).

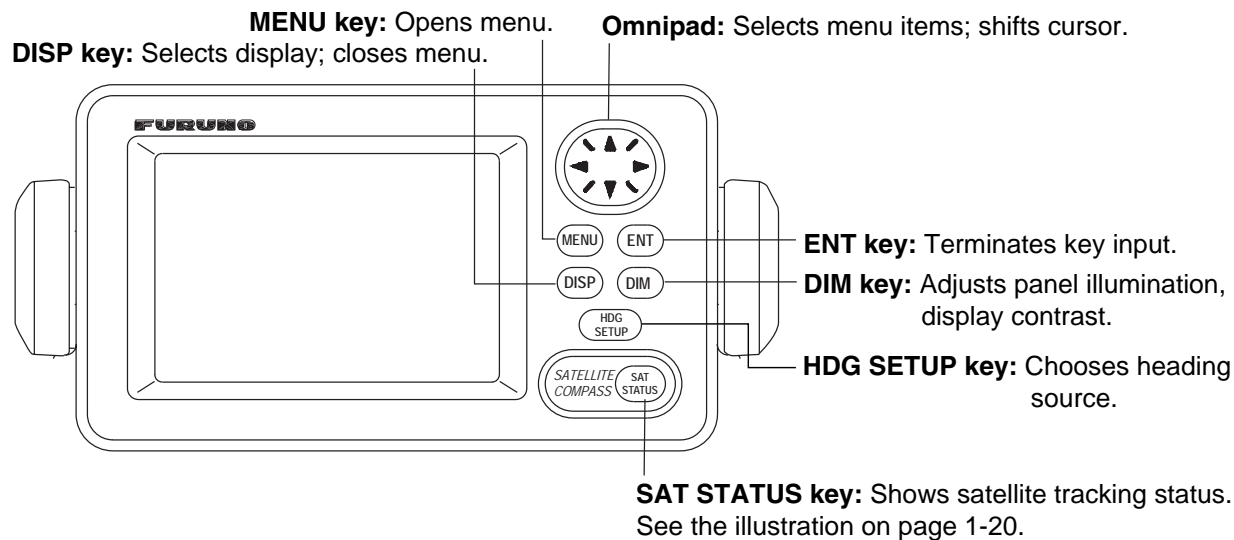
Note: The power section of this equipment is insulated so the potential of SG and FG are the same. If the shielding is not properly done, the data output IC may be damaged.

1. INSTALLATION

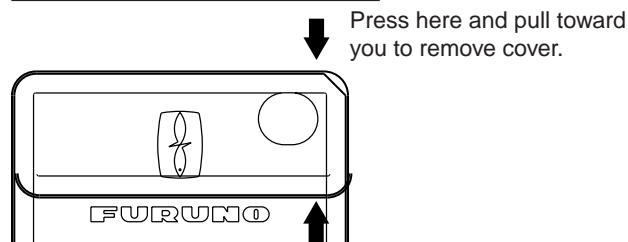
(This page intentionally left blank.)

2 OPERATION

2.1 Controls



HOW TO REMOVE THE COVER



Display unit

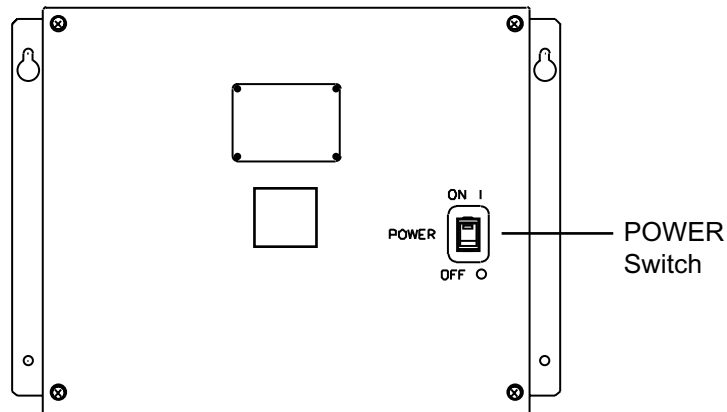
NOTICE

Reduced accuracy may occur in case of unfavorable satellite constellation, worsened HDOP, etc.

Always confirm position against other navigation devices to verify reliability.

2.2 Turning the Power On/Off

Use the power switch on the processor unit to turn the power to the display unit on and off.



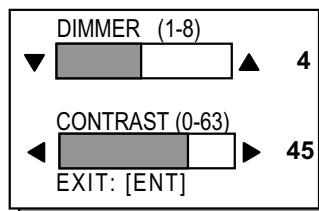
Processor unit

A beep sounds and the display starts up with the last-used display.

Note: If backup heading data is used the heading indication flashes until faithful heading data becomes available.

2.3 Panel Illumination, Display Contrast

1. Press the [DIM] key.



Dialog box for adjustment of panel illumination, display contrast

2. Press ▲ or ▼ to adjust panel illumination (dimmer).
3. Press ◀ or ▶ to adjust display contrast.
4. Press the [ENT] key.

2.4 Choosing a Display

Use the [DISP] key to show a display desired.

2.4.1 Description of displays

Heading display

The heading display shows heading, course, speed, date, time and position-fixing status. The heading status mark changes in the sequence shown below. The “final calculations” mark disappears after heading becomes reliable, which is approximately 90 seconds after that mark appears.

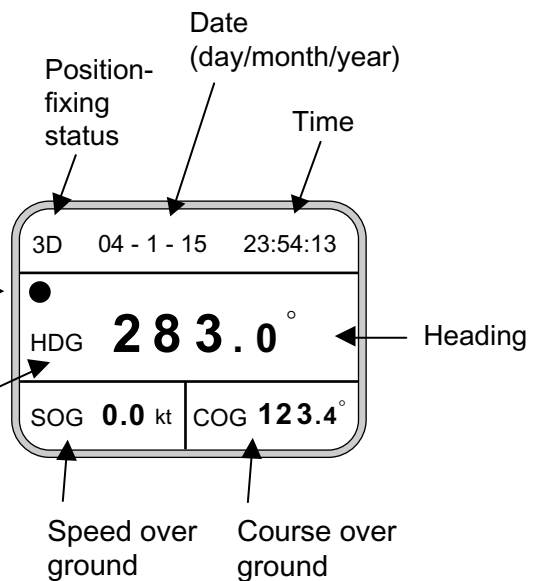
Position-fixing status indications

2D	2D GPS position fix
3D	3D GPS position fix
D2D	2D DGPS position fix
D3D	3D DGPS position fix
SIM	Simulation mode
W2D	WAAS 2D position fix
W3D	WAAS 3D position fix

Heading Calculation Status

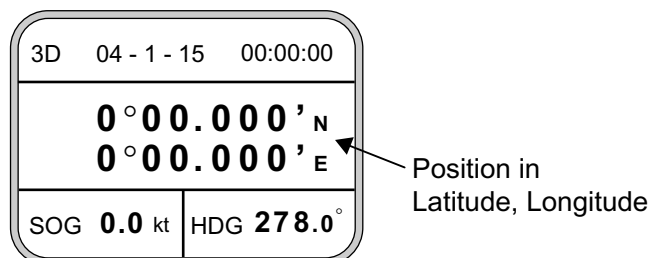
- = Acquiring satellite
- = Calculating heading
- ⊙ = Final calculations

When the data of external sensor is input, EXT (in reverse video) replaces HDG on the Heading, Nav data, Steering and Compass displays.



Nav data display

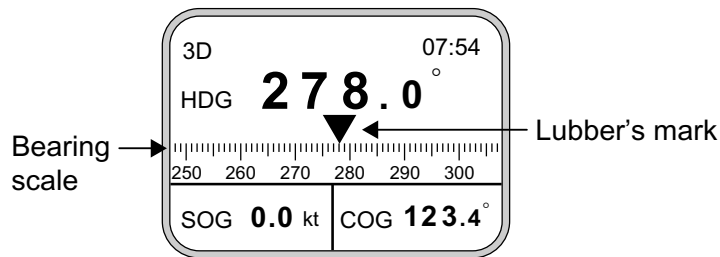
The nav data display shows position in latitude and longitude, speed, heading, date, time and position-fixing status.



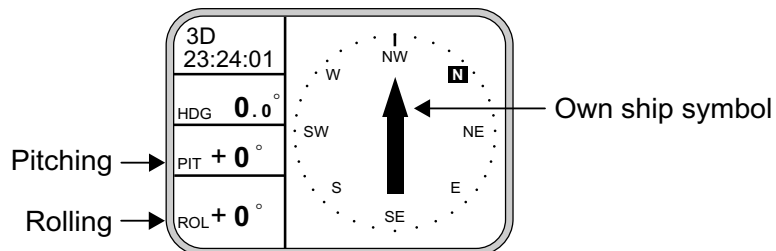
Nav data display

Steering display

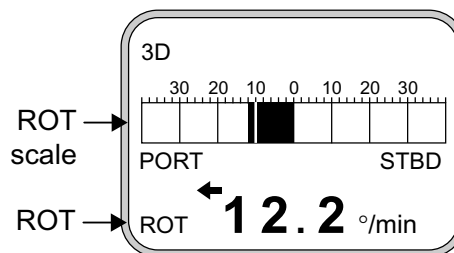
The steering display shows heading in digital and analog form. SOG and COG are also indicated. Note that COG accuracy is low when the own ship speed is low. The faster the speed, the more accurate the COG.

*Steering display***Compass display**

The compass display shows heading by compass direction. Pitch and roll are also indicated. The compass rose rotates with heading.

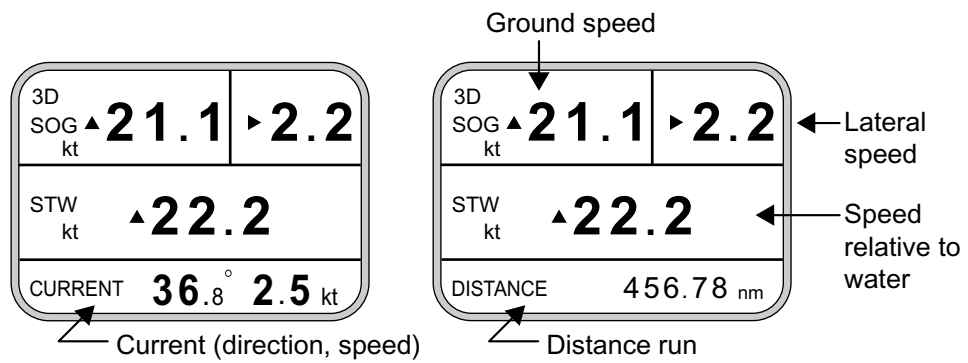
*Compass display***ROT (Rate-of-Turn) display**

The ROT display provides digital and analog indications of rate of turn.

*ROT display*

Speed display

Depending on the setting of DISTANCE DISP on the TRIP menu, the Set and Drift display or the Distance Run display is shown. The current indication requires a Doppler Speed Log.

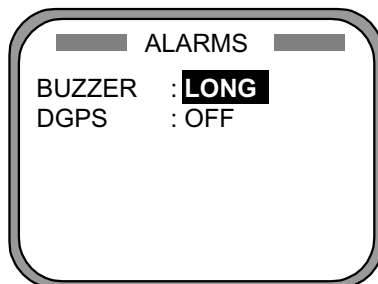


SOG/STW display

2.5 Alarm Setup

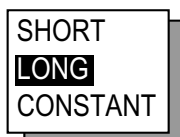
The SC-50 can alert you with audible and visual alarms when GPS signal, DPGS signal and WAAS signal are lost. To set the DGPS alarm, do the following:

1. Press the [MENU] key to show the menu.
2. Choose ALARMS and then press the [ENT] key.



Alarm menu

3. BUZZER is selected; press the [ENT] key.



Buzzer options

4. Use ▲ or ▼ to choose buzzer type desired and then press the [ENT] key.

SHORT: Two short beeps
 LONG: Three long beeps
 CONSTANT: Continuous beep

5. Press the [ENT] key.
6. DPGS is selected; press the [ENT] key.



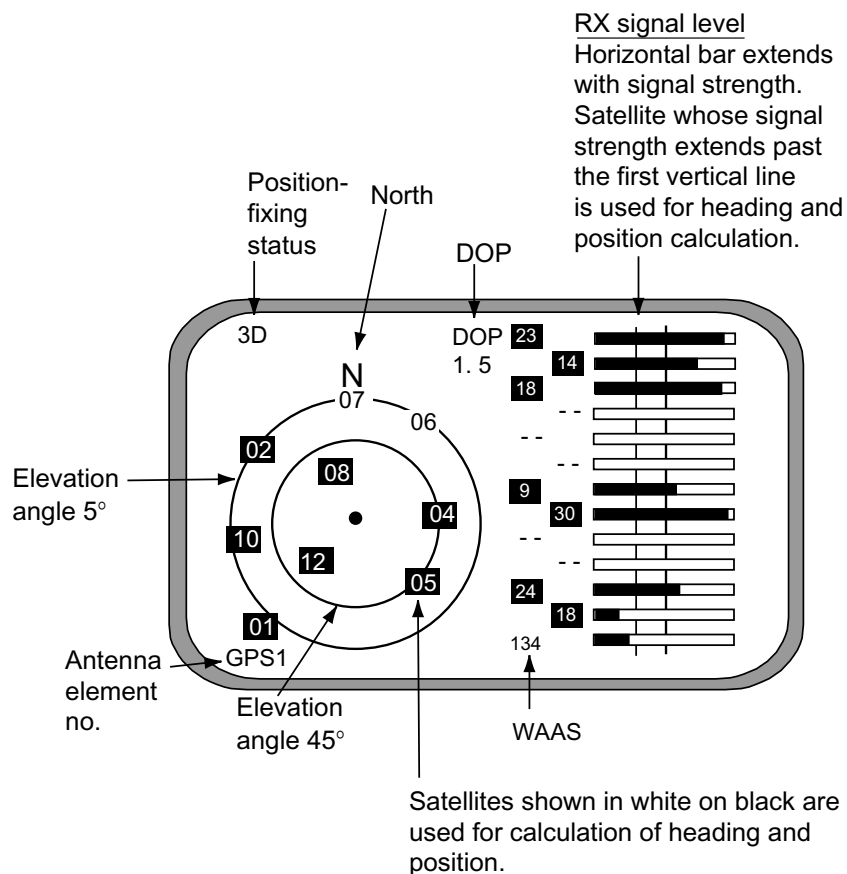
DGPS alarm options

7. Use ▲ or ▼ to choose OFF or ON as appropriate.
8. Press the [ENT] key.
9. Press the [DISP] key to close the menu.

2.6 Confirming Satellite Status

You can check the receiving condition of each antenna unit as follows:

1. Press the [MENU] key to open the menu.
2. Choose SATELLITE and then press the [ENT] key.



Satellite status display

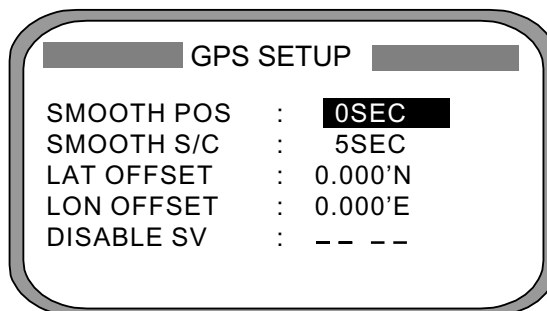
3. Use ◀ or ▶ to choose antenna element for which to confirm receiving status.
4. Press the [DISP] key to close the menu.

2.7 GPS Setup

The GPS SETUP menu smoothes position and course, averages speed, applies position offset, and deactivates unhealthy satellites.

2.7.1 Displaying the GPS setup menu

1. Press the [MENU] key to open the menu.
2. Choose GPS SETUP and then press the [ENT] key.



GPS SETUP menu

2.7.2 GPS SETUP menu description

SMOOTH POS (Smoothing position)

When the DOP (Dilution of Precision, the index for position-fixing accuracy) or receiving condition is unfavorable, the GPS fix may change randomly, even if the vessel is at anchor. This change can be smoothed by averaging a number of GPS fixes. The setting range is from 0 (no smoothing) to 999 seconds. The higher the setting, the more smoothing. However, too high a setting slows updating of position.

SMOOTH S/C (Smoothing speed/course)

Ship's speed and course are directly measured by receiving GPS satellite signals, independent of positions. The data varies with receiving conditions and other factors. You can reduce this random variation by increasing the smoothing. The higher the setting, the more that speed and course are smoothed. If the setting is too high, however, the follow-up to actual values gets slower. The setting range is from 0 (no smoothing) to 999 seconds.

LAT/LON OFFSET (L/L position offset)

If GPS fixes are erroneous while at anchor, enter a position offset to compensate for position error. Consult a nautical chart to determine latitude and longitude differences between the chart and GPS display. Enter that value as the offset.

DISABLE SV (Disable satellite)

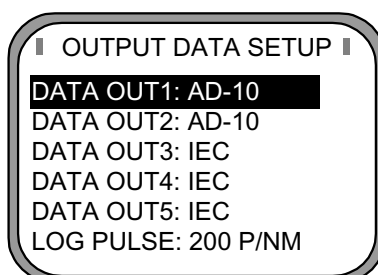
Every GPS satellite is broadcasting abnormal satellite number(s) in its Almanac, which contains general orbital data about all GPS satellites. Using this information, the GPS receiver automatically eliminates any malfunctioning satellite from the GPS satellite schedule. However, the Almanac sometimes may not contain this information. If you hear of an inoperative satellite you can disable it manually. Enter satellite number in two digits and then press the [ENT] key. To restore a satellite, enter "00".

2.8 Output Data

2.8.1 Heading

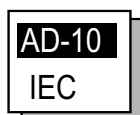
Heading data is output from the DATA OUT port on the processor unit, in IEC 61162-1/2 format.

1. Press the [MENU] key to open the menu.
2. Choose I/O SETUP and then press the [ENT] key.



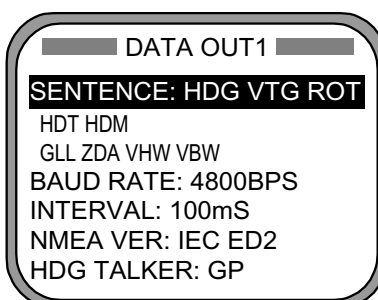
OUTPUT DATA SETUP menu

3. Choose DATA OUT1 and then press the [ENT] key.



Data out options

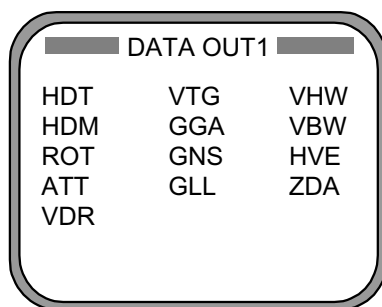
4. Use the Omnipad to choose AD-10 or IEC as appropriate and then press the [ENT] key. If you choose AD-10, no further operation is required; go to step 18 to finish. For IEC go to the next step.



DATA OUT1 menu

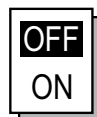
2. OPERATION

5. Choose SENTENCE and then press the [ENT] key.

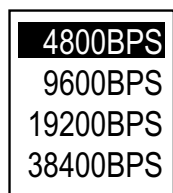


DATA OUT1 menu, sentences

6. Use the Omnipad to choose a sentence and then press the [ENT] key.
- HDT: True heading (required for radar, AIS, ECDIS, etc.)
 - HDM: Magnetic heading (HDM is obtained in this equipment by adding the magnetic variation to HDT.)
 - ROT: Rate-of-turn data
 - ATT: True heading, pitching, rolling (FURUNO's proprietary sentence)
 - VDR: Set and drift
 - VTG: Course over ground and ground speed
 - GGA: Global positioning system (GPS) fix data
 - GNS: GNSS fix data
 - GLL: Geographic position, latitude/longitude
 - VHW: Water speed and heading
 - VBW: Dual ground/water speed
 - HVE: GPS antenna up-down motion amplitude (FURUNO proprietary sentence)
 - ZDA: Time and date

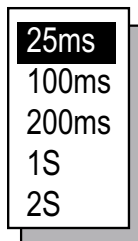


7. Use the Omnipad to choose OFF or ON as appropriate and then press the [ENT] key. Sentences selected for output are marked with an asterisk.
8. Repeat steps 6 and 7 for other items. All sentences cannot be selected. The message "SENTENCE OVERLOAD" appears when too many sentences have been selected. Change settings as appropriate. For further information see page 2-12.
9. Press the [MENU] key to return to the DATA OUT1 menu.
10. Choose BAUD RATE and then press the [ENT] key.



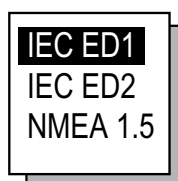
Baud rate options

11. Use the Omnipad to choose the baud rate of the equipment connected and then press the [ENT] key.
12. INTERVAL is selected; press the [ENT] key.



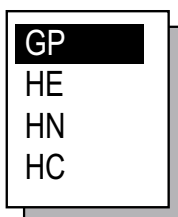
Tx interval options

13. Use the Omnipad to choose appropriate output interval and then press the [ENT] key.
14. Choose IEC VERSION and then press the [ENT] key.



IEC, NMEA version options

15. Choose appropriate IEC (or NMEA) edition and then press the [ENT] key.
16. Choose HDG TALKER and then press the [ENT] key.



Heading talker options

17. Choose appropriate heading talker and then press the [ENT] key.
 - GP: GPS navigator talker
 - HE: North-seeking gyrocompass talker
 - HN: Non-north seeking gyrocompass talker
 - HC: Magnetic compass talker
18. Press the [DISP] key to close the menu, or press the [MENU] key to return to the I/O SETUP menu to setup another output port.

2. OPERATION

Output sentence limitation

The number of sentences which can be output depends on baud rate and output interval settings. The maximum number of characters per each data sentences are shown in the table below and the total number of characters must satisfy the formula shown below. The number of characters which can be output “N” is calculated by the following formula

$$N \leq 0.083 \times T \times B$$

T: Interval (s)

B: Baud rate

Sentence and maximum number of characters

Sentence	HDT	HDM	ROT	ATT	HVE	VTG*	GGA*	GNS*	GLL*	ZDA*	VHW*	VBW*	VDR*
No. of Characters	19	19	21	34	23	46	66	62	47	36	44	45	35

*: Output is 1 s if interval set is shorter than 1 s.

For example, the baud rate is 4800 bps, interval is 100 ms (= 0.1 s). Therefore, the number of characters is $N < 0.083 \times 0.1(\text{s}) \times 4800(\text{bps}) = 39.4$.

Then, the number of characters which can be output is 39. For sentences (sentences not having an asterisk in the table) where the output interval is variable the number of characters is as shown in the table, however sentences where the output interval is not smaller than 1 s (asterisk-marked sentences in table) the number of characters which can be output is “number of characters in table” x “setting interval.”

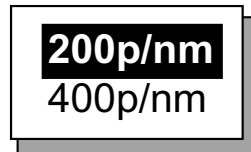
For the above settings the following applies:

- If both HDT and HDM are selected the total number of characters is $19+19 = 38$. Since the count is less than 39 both can be selected.
- If both HDT and VTG are selected the total number of characters is $19+46 \times 0.1 = 23.6$. Since the count is less than 39 both can be selected.
- If HDT, HDM and VTG are selected the total number of characters is $19+19+46 \times 0.1 = 42.6$. In this case, the message “SENTENCE OVERLOAD” appears.

2.8.2 Log pulse

This equipment provides SOG (speed over ground) in high accuracy. It converts an SOG value to a pulse signal and outputs at the rate of 200 or 400 pulses/nm.

1. Press the [MENU] key.
2. Choose I/O SETUP and then press the [ENT] key.
3. Choose LOG PULSE and then press the [ENT] key.



Log pulse options

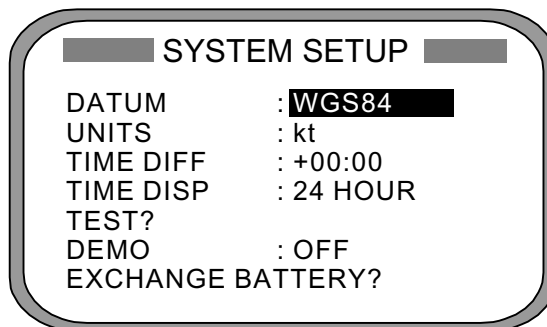
4. Choose 200p/nm or 400p/nm as appropriate and then press the [ENT] key.
5. Press the [DISP] key to close the menu.

2.9 System Setup

2.9.1 Geodetic data

Your unit is preprogrammed to recognize most of the major chart systems of the world. Although the WGS-84 system (default setting) is the GPS standard, other categories of charts in other datum still exist. Match the GPS datum with the chart system you use.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.



SYSTEM SETUP menu

3. Confirm that the cursor is selecting DATUM and then press the [ENT] key.
4. Choose WGS84 (GPS standard), WGS72 or OTHER according to the nautical chart you use and then press the [ENT] key.
5. If you chose WGS72 or WGS84, press the [DISP] key to finish. For OTHER, go to step 6.
6. Press the [ENT] key.
7. Use the Omnipad to enter chart number, referring to the geodetic chart list on page A-2. Choose location with ◀ or ▶; change value with ▲ or ▼.
8. Press the [ENT] key.
9. Press the [DISP] key to close the menu.

2.9.2 Units of measurement

Distance/speed can be displayed in nautical miles/knots, kilometers/kilometers per hour, or miles/miles per hour.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.
3. Choose UNITS.
4. Press the [ENT] key.
5. Choose unit of measurement combination desired; kt, km/h, mi/h.
6. Press the [ENT] key.
7. Press the [DISP] key to close the menu.

2.9.3 Using local time

GPS uses UTC time. If you would rather use local time, enter the time difference (range: -13:30 to +13:30) between local time and UTC.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.
3. Choose TIME DIFF and then press the [ENT] key.
4. Press ▲ or ▼ to display + or – as appropriate.
5. Enter time difference with the Omnipad. Choose digit with ◀ or ▶; change value with ▲ or ▼.
6. Press the [ENT] key.
7. Press the [DISP] key to close the menu.

2.9.4 Time format

Time can be displayed in 12 hour or 24 hour format.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.
3. Choose TIME DISP and then press the [ENT] key.
4. Choose 12HOUR or 24HOUR as appropriate and then press the [ENT] key.
5. Press the [DISP] key to close the menu.

2.9.5 Demonstration mode

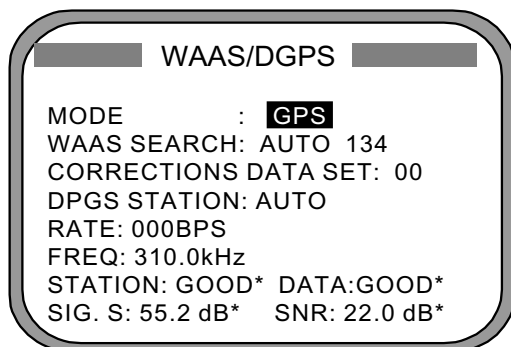
The demonstration mode provides simulated operation of the equipment.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.
3. Choose DEMO and then press the [ENT] key.
4. Choose ON or OFF as appropriate and then press the [ENT] key.
5. Press the [DISP] key to close the menu.

The indication SIM appears at the top of the screen when the demonstration mode is active. When the demonstration mode is first made active, SIMULATION MODE appears when the power is turned on and it is erased when any key is pressed.

2.10 WAAS/DGPS Setup

1. Press the [MENU] key to open the menu.
2. Choose WAAS/DGPS and then press the [ENT] key.



STATION: Shows GOOD or NG.

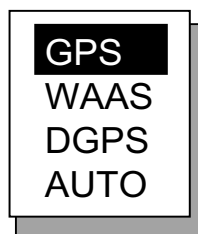
DATA: Shows GOOD or NG.

SIG. S: Signal Strength. A figure between 0 and 99 is shown. The higher the figure the stronger the beacon signal.

SNR: Signal to Noise Ratio. A figure between 1 and 22 is shown. When your boat is in the service area of a beacon station, SNR should be 21 or 22. If the figure is below 21 the position will be inaccurate. If this happens, check for radar interference, poor ground and generator noise on own ship.

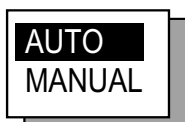
WAAS/DGPS menu

3. MODE is selected; press the [ENT] key.



Position fix mode options

4. Choose appropriate mode referring to the description below and then press the [ENT] key.
 - GPS: Position fix by GPS
 - WAAS: Position fix by WAAS
 - DPGS: Position fix by DGPS (external beacon receiver required)
 - AUTO: Position fix in order of DGPS, WAAS and GPS
5. For WAAS or AUTO do as below. For DGPS go to step 6; for GPS go to step 8.
 - 1) WAAS SEARCH is selected; press the [ENT] key.

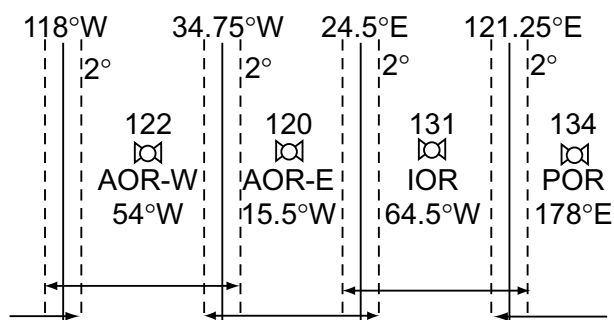


WAAS SEARCH options

2. OPERATION

- 2) Use the Omnipad to choose WAAS satellite search method, AUTO or MANUAL as appropriate. For MANUAL, press the [ENT] key, enter appropriate WAAS satellite referring to the illustration below and then press the [ENT] key.

Provider	GEO Satellite	Longitude
WAAS	POR (134)	178°E
	AOR-W (122)	54°W
EGNOS	AOR-E (120)	15.5°W
	IOR (131)	64.5°E



One-degree threshold

Longitude Range	Satellite
120.25°E to 117°W	134
119°W to 33.75°W	122
35.75°W to 25.5°E	120
23.5°E to 122.25°E	131

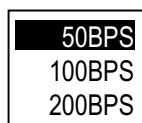
GEO satellite and coverage area

- 3) CORRECTIONS DATA SET is selected; press the [ENT] key.
CORRECTIONS DATA SET determines how to use the WAAS signal. Use the default setting "00". Do step 6 and 7 for DGPS.
6. Choose DPGS STATION and press the [ENT] key.



AUTO/MANUAL options

7. Choose MANUAL or AUTO as appropriate and press the [ENT] key. For AUTO got to step 8. For MANUAL do the following:
 - 1) RATE is selected; press the [ENT] key.



Baud rate options

- 2) Choose appropriate baud rate and press the [ENT] key.

- 3) FREQ is selected; press the [ENT] key.
 - 4) The cursor is selecting the hundredths digit so press ▲ or ▼ to display appropriate digit. Press ► to shift the cursor to the tenths place.
 - 5) Set other digits appropriately.
8. Press the [DISP] key to close the menu.

2.11 OTHERS Menu

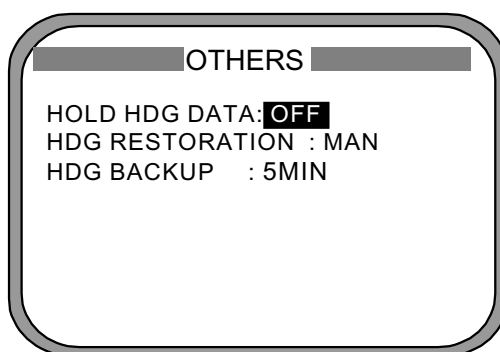
The OTHERS menu contains the following items:

HOLD HDG DATA: Choose whether to display last-used heading data at power on or not. Because this data is not reliable, the heading indication flashes to alert you.

HDG RESTORATION: Choose how to restore GPS signal, automatically or manually, after it is lost. For manual restoration, a key must be pressed to restart heading output. This is done for safety purposes; for example, when an autopilot is used.

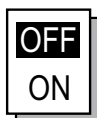
HDG BACKUP: Choose how long to display backup data when the GPS signal is lost. (This data is also output to external equipment.)

1. Press the [MENU] key to display the main menu.
2. Choose OTHERS and then press the [ENT] key.



Others menu

3. HOLD HDG DATA is selected; press the [ENT] key.



4. Choose ON or OFF as appropriate.
5. Press the [ENT] key.
6. HDG RESTORATION is selected; press the [ENT] key.



HDG RESTORATION options

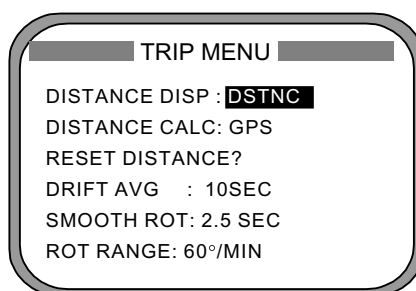
7. Use the Omnipad to choose MAN or AUTO as appropriate and then press the [ENT] key.
8. HDG BACKUP is selected; press the [ENT] key.
9. Choose 1, 2, 3, 4 or 5 minutes as appropriate.
10. Press the [ENT] key followed by the [DISP] key to close the menu.

2.12 TRIP Menu

The TRIP menu functions to

- Choose the indication to show on the SOG/STW display
- Choose source of distance run
- Reset distance run to zero
- Smooth the tide drift indication
- Enter smoothing for rate of turn and display range scale

1. Press the [MENU] key to display the main menu.
2. Choose TRIP MENU and then press the [ENT] key.



TRIP menu

3. Choose DISTANCE DISP and then press the [ENT] key.
4. Choose what to display on the Speed display; distance run (DSTNC) or tide direction and speed (DRIFT). Press the [ENT] key.
5. Choose DISTANCE CALC and then press the [ENT] key.
6. Choose the source for distance run; GPS, VLW (distance traveled through water) or VBW (Dual ground/water speed). (VLW requires DS-80 type Doppler speed log and VBW requires Current indicator or Doppler speed log.) Press the [ENT] key.
7. Choose DRIFT AVG. and then press the [ENT] key.
8. If tide current and speed data is unstable, enter a smoothing figure to stabilize the data. The higher the figure the more smoothed the data. A setting between 0 (no smoothing) and 9999 (seconds) is available.
9. Choose SMOOTH ROT and then press the [ENT] key.
10. Use the Omnipad to enter rate of turn smoothing rate. Choose location with ◀ or ▶; change value with ▲ or ▼. The setting range is 0.1 to 30.0 (seconds).
11. Press the [ENT] key.
12. Choose ROT RANGE and then press the [ENT] key.
13. Choose the range of the ROT graph from among 30, 60 and 90 (degree/min.) and then press the [ENT] key.
14. Press the [DISP] key to close the menu.

2.13 Resetting Distance Run

The distance run may be reset to zero as below when the source of distance run is GPS or VBW.

1. Press the [MENU] key to display the main menu.
2. Choose TRIP MENU and then press the [ENT] key.
3. Choose RESET DISTANCE and then press the [ENT] key.

RESET DISTANCE?

 ARE YOU SURE?
 YES **NO**

RESET DISTANCE prompt

4. Choose YES and then press the [ENT] key.
5. Press the [DISP] key to close the menu.

2.14 Choosing External Heading Source for Backup

Choose the source of heading data as below.



CAUTION

Never switch from internal to external heading while the autopilot is in the automatic mode. Change to the manual mode before switching.

2. Press the [HDG SETUP] key.

HEADING SETUP

OFFSET : **+000.0**
 (SERVICE ONLY)

HEADING : INT

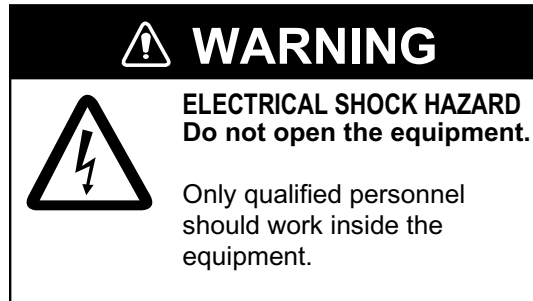
INT HDG ---.°
 EXT HDG ---.°

- OFFSET : Heading offset. See service manual for instructions. "SERVICE ONLY" means heading offset shown for display only.
- HEADING : Select heading source. Choose INT for normal use. If a gyrocompass is connected for primary means, leaving this equipment as backup, choose EXT.
- INT HDG : Bow heading. Includes offset.
- EXT HDG : Heading fed from external equipment.

Heading setup menu

3. "HEADING" is selected; press the [ENT] key.
4. Choose INT or EXT as appropriate. Normally choose INT. If own GPS sensor is not working and a heading sensor such as a gyrocompass is available, choose EXT.
5. Press the [ENT] key.
6. Press the [DISP] key to close the menu.

3 MAINTENANCE, TROUBLESHOOTING



3.1 Preventive Maintenance

Regular maintenance is important for good performance. A maintenance program should be established and should include the following points.

- Check connectors and ground terminal on the processor unit and display unit for tightness.
- Check ground terminal for rust. Clean or replace as necessary.
- Check for water leakage in the antenna cable. Replace the cable if there are signs of water leakage.
- Remove dust and dirt from the display unit and processor unit with a dry, soft cloth. For the LCD, wipe it carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove stubborn dirt, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt. Change paper frequently so the dirt will not scratch the LCD. Do not use chemical cleaners for cleaning - they can remove paint and markings.

3.2 Troubleshooting

This section provides basic troubleshooting procedures which the user may follow to restore normal operation.

Troubleshooting

Symptom	Cause	Remedy
Cannot turn on the power.	Power cable on the processor unit	Firmly connect the power cable
	Power supply failure	Check the power supply.
	Blown fuse	Have a qualified technician check the fuse.
Heading indication changes randomly when ship is at anchor or does not change when ship moves.	Sensor trouble	Run the diagnostic test ² to determine cause.
Heading output from SC-50 does not appear on external equipment.	Connection between SC-50 and external equipment has loosened.	Firmly fasten the connector.
	Sensor trouble	Run the diagnostic test ¹ to determine the cause.

If large heading error occurs or heading indication is frequently interrupted, contact your dealer for advice.

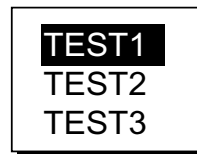
3.3 Diagnostics

Diagnostic test1

The diagnostic test1 checks the equipment for proper operation.

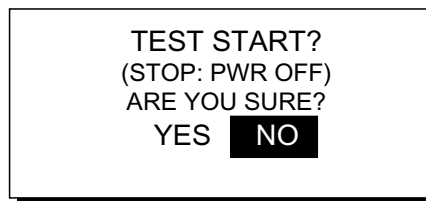
Note: Heading is not output during the diagnostic test, and this is communicated with an appropriate message. After completing the diagnostic test, turn the power off and on to update heading data.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.
3. Choose TEST? and then press the [ENT] key.



Test menu options

4. Confirm that TEST1 is selected and then press the [ENT] key.

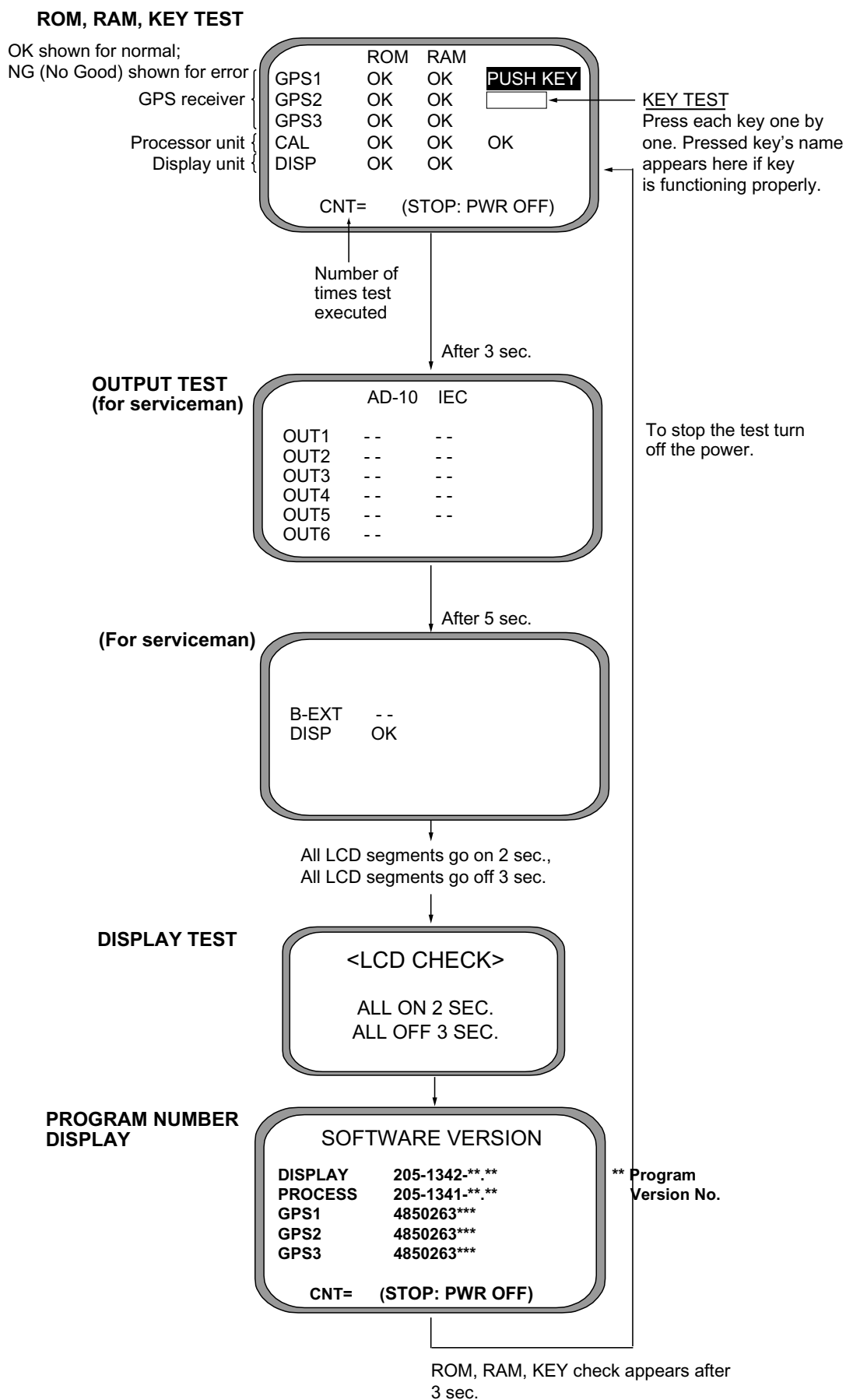


Test start prompt

5. Press ◀ to choose YES and then press the [ENT] key. The test proceeds in the sequence shown on the next page.

Note: The output port test (see next page) is intended for the service technician, using a special test connector. If TEST1 is conducted without the test connector, disconnect the DATA IN connector from the processor unit.

3. MAINTENANCE, TROUBLESHOOTING



Diagnostic test sequence

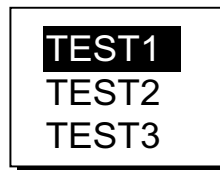
6. Turn off the processor unit to quit the diagnostic test1.

Diagnostic test2

If the heading indication changes randomly when ship is at anchor or does not change when the ship moves, run the test2 following the procedure below, with the ship at anchor and satellite signal received.

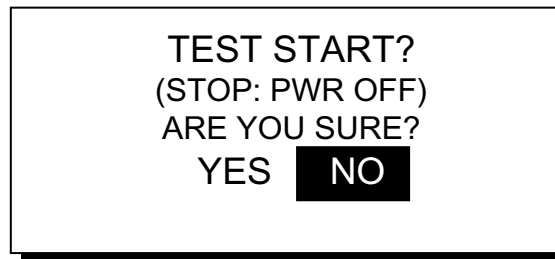
Note: Heading is not output during the diagnostic test, and this is communicated with an appropriate message. After completing the diagnostic test, turn the power off and on to update heading data.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.
3. Choose TEST? and then press the [ENT] key.



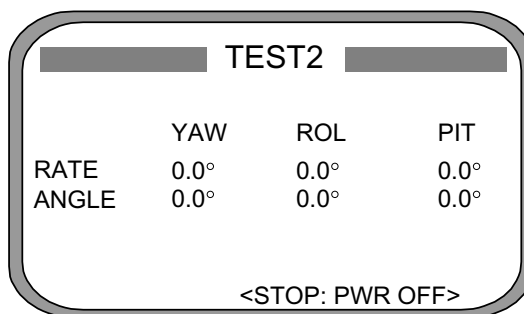
Test menu options

4. Choose TEST2 and then press the [ENT] key.



Test start prompt

5. Press ◀ to choose YES and then press the [ENT] key.
6. Press the [ENT] key twice. Rate and angle values are 0.0°. If the values increase or decrease markedly (with ship at anchor), suspect rate sensor trouble. Contact your dealer to request service.



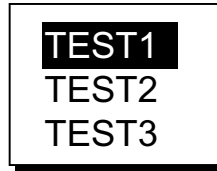
TEST2 display

7. Turn off the processor unit to quit the diagnostic test2.

Diagnostic test3

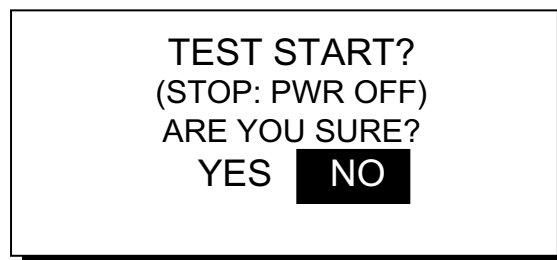
This test checks the buzzer signal/contact for proper operation.

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.
3. Choose TEST? and then press the [ENT] key.



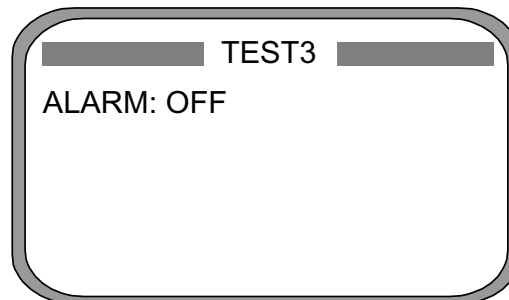
Test menu options

4. Choose TEST3 and then press the [ENT] key.



Test start prompt

6. Press ◀ to choose YES and then press the [ENT] key.



TEST3 menu

7. Press the [ENT] key.



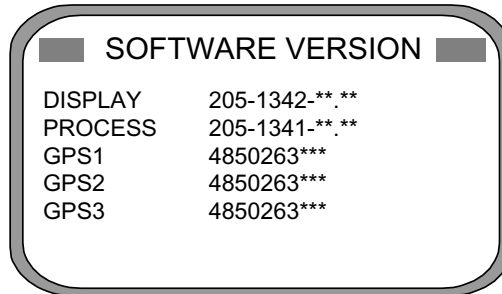
ALARM options

8. Choose OFF or ON as appropriate and then press the [ENT] key.
OFF: Buzzer sound goes off, alarm contact signal is closed.
ON: The buzzer sounds and the alarm contact is open.
9. To quit the test, turn off the processor unit.

3.4 Program Number

You may display the program number as follows:

1. Press the [MENU] key to open the menu.
2. Choose SOFT VER. and then press the [ENT] key.



** = Program version no.

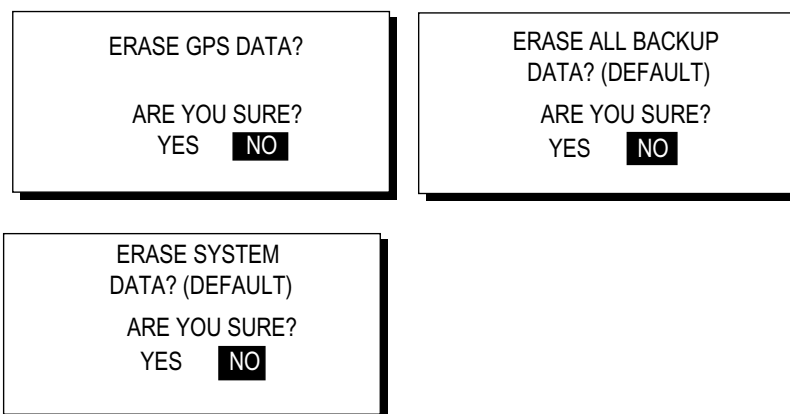
Program number display

3. Press the [DISP] key to close the program version no. display.

3.5 Clearing Data

You may clear GPS data and system data all at once or individually as follows:

1. Press the [MENU] key to open the menu.
2. Choose ERASE and then press the [ENT] key.



Prompts for erasure of data

3. Choose GPS DATA?, SYSTEM DATA? or ALL BACKUP DATA? (clears GPS and SYSTEM data) as appropriate. One of the following displays appears depending on your selection.
4. Press ◀ to choose YES and then press the [ENT] key to erase. After data is erased the message "Completed erasing. Turn off the unit." is displayed.

Note: MOUNTING, DIRECTION and LANGUAGE in the INST menu, HDG RESTORATION and HDG BACKUP in the OTHERS menu and OFFSET in the HEADING SETUP menu are not cleared.

5. Turn off and on the power.

3.6 Replacement of Battery

The processor unit has a battery which stores data when the power is turned off. When the battery voltage is low, the message “BATTERY!” appears on the display. Have a qualified technician replace the battery, following the procedure below. The life of the battery is 3-5 years.

Battery Location	Type	Code No.
Processor Unit	CR2450-F2ST2L	000-144-941

1. Press the [MENU] key to open the menu.
2. Choose SYS SETUP and then press the [ENT] key.
3. Choose “EXCHANGE BATTERY?” and then press the [ENT] key.

EXCHANGE BATT?
ARE YOU SURE?

YES **NO**

Prompt for exchanging battery

4. Press ◀ to choose YES and then press the [ENT] key. The following message appears.

READY FOR
BATTERY CHANGE.
TURN OFF THE
UNIT.

Prompt for turning off the power

5. At this time the contents of the RAM are temporarily moved to the flash memory. Turn off the power.
6. Have a qualified technician replace the battery.

Note: If the equipped will not be used for a long period of time, save data by following the above procedure. This will prevent loss of data even if the battery dies.

3.7 Replacement of Fuse

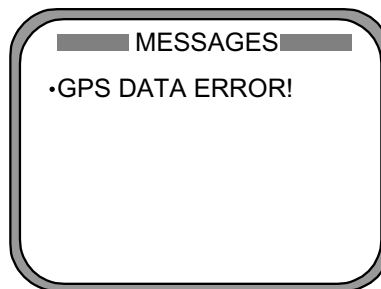
The 3 A fuse on the POWER Board inside the processor unit protects the equipment from overcurrent and reverse polarity of the power supply. If the fuse blows, have a qualified technician check the fuse.



3.8 Error Messages

The alarm sounds for equipment error and is accompanied by a flashing exclamation mark (⚠). Press any key to silence the alarm. The exclamation mark remains on the screen until the cause for error is eliminated. Find the cause for the alarm(s) as follows:

1. Press the [MENU] key to open the menu.
2. Choose MESSAGES and then press the [ENT] key.



Message display

3. Press the [DISP] key to close the menu.

Error messages

Error Message	Meaning	Remedy
ABORTING!	GPS heading error continues for one minute. For example, satellite cannot be acquired because of unfavorable environment.	Check for obstruction.
ABORTING CALC!	GPS signal lost for one minute.	Press any key to try to restore normal operation.
BACKUP ERROR!(DISP)	Corrupted backup data found in display unit at power on.	Default settings are automatically restored.
BACKUP ERROR!(PRCSSR)	Corrupted backup data found at processor unit at power on.	Default settings are automatically restored.

(Continued on next page)

3. MAINTENANCE, TROUBLESHOOTING

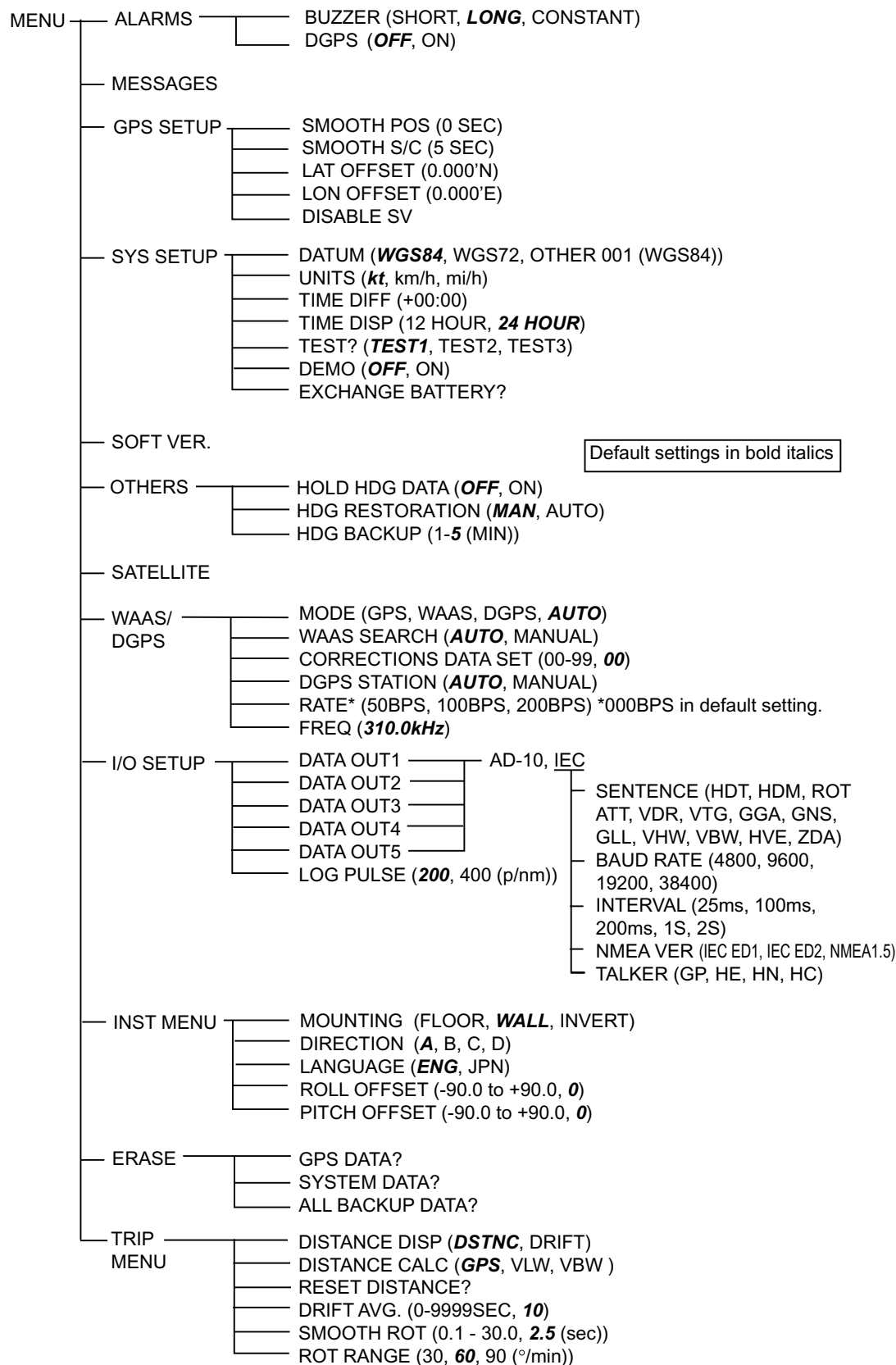
Error messages (con't from previous page)

Error Message	Meaning	Remedy
BATTERY ALM!	Voltage of battery in processor unit is low.	Have battery replaced at earliest convenience.
DATA ERR!	GPS data (from the GPS receiver in the processor unit) is lost for one minute. Heading output is stopped and the heading indication shows "- - -".	Check GPS receiver.
DGPS ERROR!	DGPS data (from external DGPS receiver) is lost for one minute.	Ship may not be within DPGS service area.
GPS DATA ERROR!	GPS data (from internal GPS receiver) is lost for one minute. Heading output is stopped and the heading indication shows "- - -".	Conduct diagnostic test ¹ and check if NG appears for results for GPS receivers GPS1, GPS2 and GPS3.
GPS NO FIX!	No GPS data.	Check antenna cable.
HDG ERROR!	Heading error	Request service.
NO HEADING OUTPUT!	GPS heading error continues for five* minutes. In this case the heading indication shows "- - -" and heading output is stopped. * = default setting. May be changed by "backup" setting.	Press any key to try to restore normal operation.
RAM ERROR!	RAM problem	Request service.
RATE ERROR(YAW)!	Data output stopped.	Request service.
RATE ERROR(ROLL)!	Data output stopped.	Request service.
RATE ERROR(PITCH)!	Data output stopped.	Request service.
COMMUNICATION ERR!	Communication between display unit and processor has been interrupted.	Request service.
WAAS ERROR	WAAS data lost for one minute.	Request service.
ROM ERROR!	ROM problem	Request service.

*: Alarm port goes open when message appears.

APPENDIX

1. Menu Tree



2. Digital Interface

Output sentences of channel 1

DATA OUT1-5: HDT, HDM, ROT, Patt, Phve, VTG, GGA, GLL, GNS, ZDA, VHW, VBW, VDR
DATA OUT 6: AD-10

Transmission interval

HDT, HDM, ROT, Patt, Phve: 100 ms

VTG, GGA, GLL, GNS, ZDA, VHW, VBW, VDR: 1 s

For details see page 2-12.

Load requirement as listener

Isolation: Optocoupler

Input Impedance: 220 ohms

Max. Voltage: $\pm 15V$

Threshold: 4 mA

Data transmission

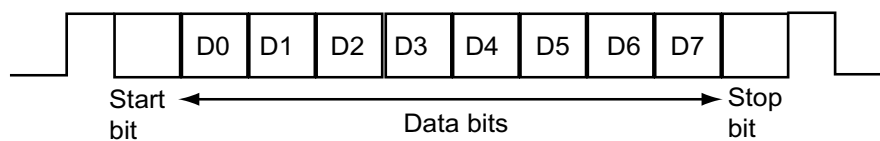
Data is transmitted in serial asynchronous form in accordance with the standard referenced in 2.1 of IEC 61162-1. The first bit is a start bit and is followed by data bits, least-significant-bit as illustrated below.

The following parameters are used:

Baud rate: 4800

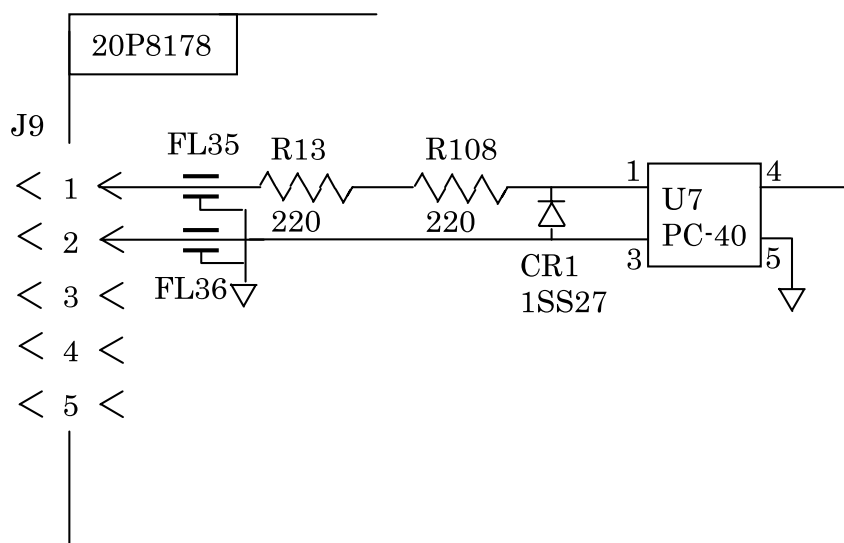
Data bits: 8 (D7 = 0), parity none

Stop bits: 1



Schematic diagrams

Data IN



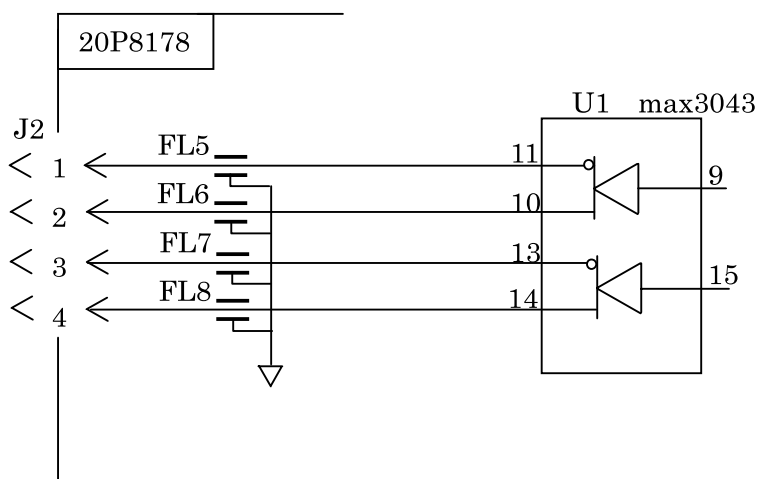
Load requirements

Isolation: Optocoupler

Input Impedance: 440 ohm

Max. voltage: $\pm 15V$

Data Out 1-6



Output drive capability

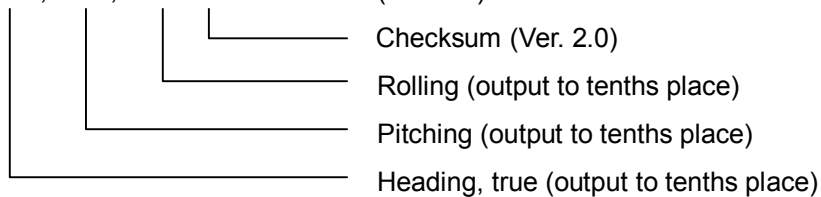
Max : 10mA

Data sentences

PFECatt- True heading, pitching, rolling

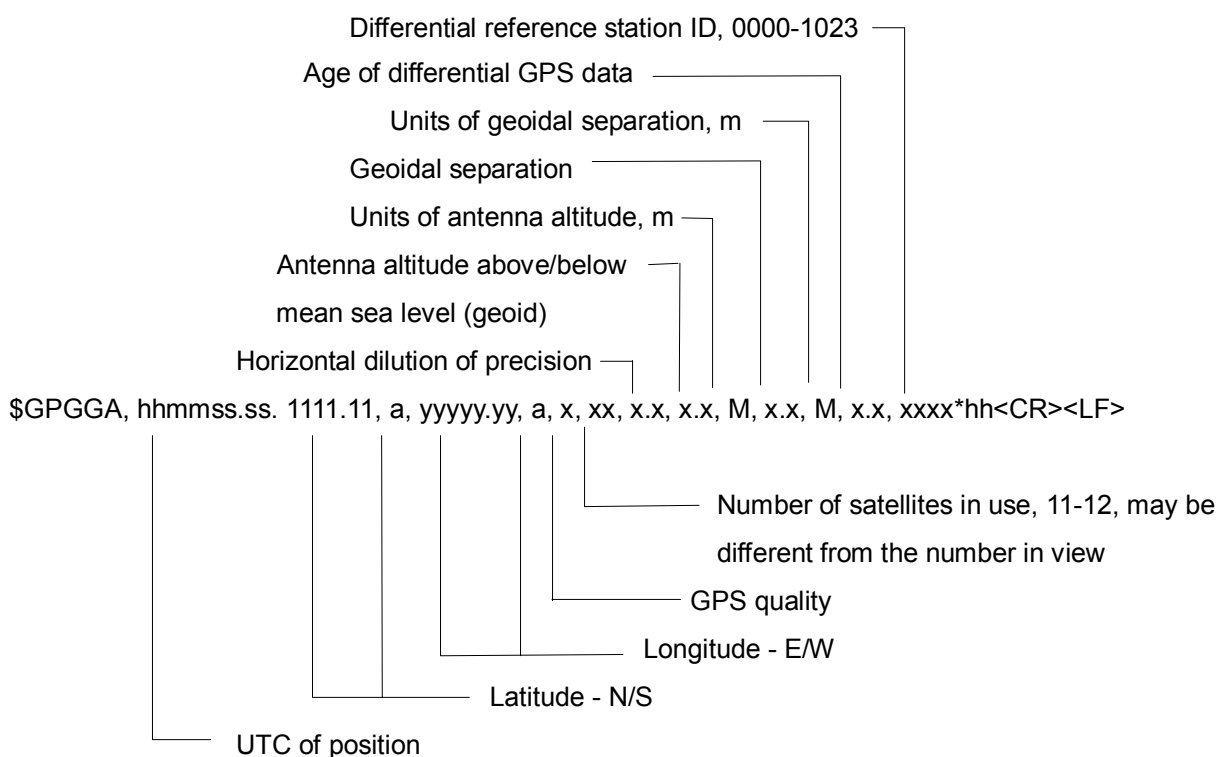
\$PFEC,GPatt,xxx.x,+xx.x,-xx.x<CR><LF> (Ver. 1.5)

\$PFEC,GPatt,xxx.x,+xx.x,-xx.x*hh<CR><LF> (Ver. 2.0)



GGA - Global positioning system (GPS) fix data

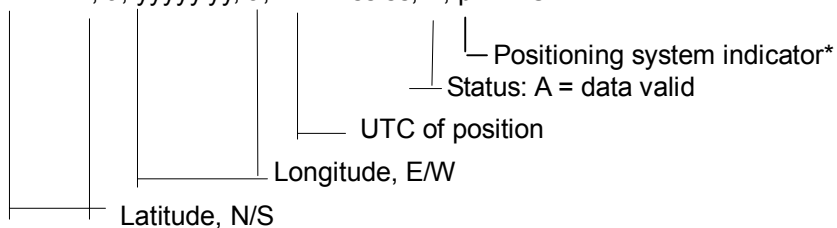
Time, position and fix related data for a GPS receiver.



GLL - Geographic position - latitude/longitude

Latitude and longitude of present vessel position, time of position fix and status.

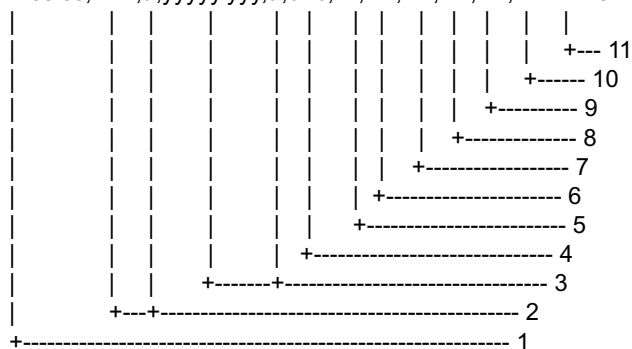
\$--GPGLL, 1111.11, a, yyyy.yy, a, hhmmss.ss, A, p*hh<CR><LF>



*A = Autonomous, D = Differential, E = estimated(dead reckoning), M = Manual input, S = Simulator, N = Data not valid. The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

GNS - GNSS fix data

\$--GNS,hhmmss.ss,llll.lll,a,yyyyy.yyy,a,c--c,xx,x.x,x.x,x.x,x.x,x.x*hh<CR><LF>

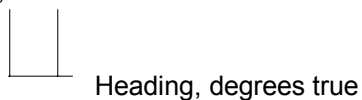


1. UTC of position
2. Latitude, N/S
3. Longitude, E/W
4. Mode indicator
5. Total number of satellite in use,00-99
6. HDOP
7. Antenna altitude, metres, re:mean-sea-level(geoid)
8. Geoidal separation
9. Age of differential data
10. Differential reference station ID
11. Checksum

HDM- Heading – magnetic

This sentence is not used in the current version of NMEA and IEC 61162. Some boaters may want the GPS compass to indicate the magnetic heading when the boat is only fitted with a magnetic compass. HDG is calculated by adding a geomagnetic variation to HDT.

\$--HDM, x.x, M *hh<CR><LF>

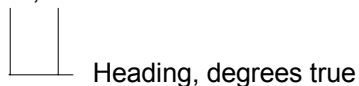


Heading, degrees true

HDT - Heading - true

True heading in degrees obtained by processing RF cycle in the GPS carrier frequency.

\$--HDT, x.x, T*hh<CR><LF>

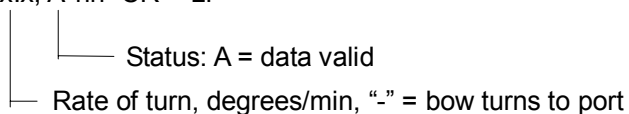


Heading, degrees true

ROT – Rate of turn

ROT derived from a changing rate of GPS compass heading.

\$--ROT, x.x, A*hh<CR><LF>

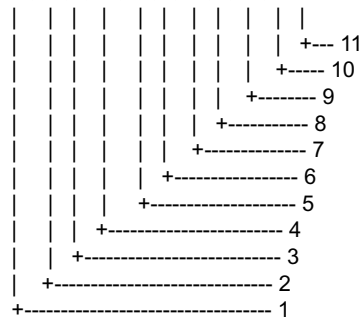


Status: A = data valid

Rate of turn, degrees/min, “-” = bow turns to port

VBW - Dual ground/water speed

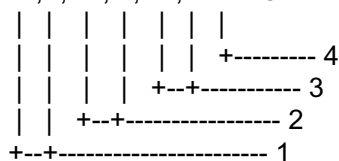
\$--VBW,x.x,x.x,A,x.x,x.x,A,x.x,A*x,hh<CR><LF>



1. Longitudinal water speed, knots
2. Transverse water speed, knots
3. Status: water speed, A=data valid V=data invalid
4. Longitudinal ground speed, knots
5. Transverse ground speed, knots
6. Status: ground speed, A=data valid V=data invalid
7. Stern transverse water speed, knots
8. Status: stern water speed, A=data valid V=data invalid
9. Stern transverse ground speed, knots
10. Status: stern ground speed, A=data valid V=data invalid
11. Checksum

VDR - Set and drift

\$--VDR,x.x,T,x.x,M,x.x,N*hh<CR><LF>

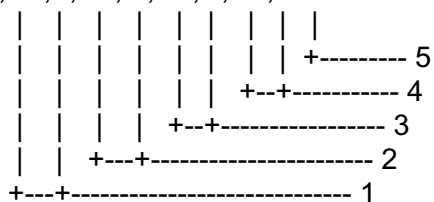


1. Direction, degrees true
2. Direction, degrees magnetic
3. Current speed, knots
4. Checksum

VHW - Water speed and heading

The compass heading to which the vessel points and the speed of the vessel relative to the water.

\$--VHW,x.x,T,x.x,M,x.x,N,x.x,K*hh<CR><LF>

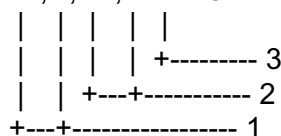


1. Heading, degrees true
2. Heading, degrees magnetic
3. Speed, knots
4. Speed, km/h
5. Checksum

VLW - Distance travelled through the water

The distance travelled, relative to the water.

\$--VLW,x.x,N,x.x,N*hh<CR><LF>

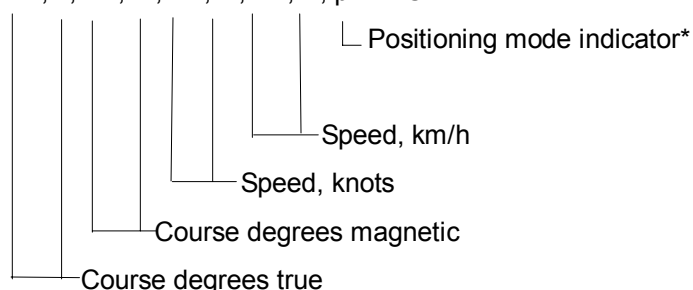


1. Total cumulative distance, nautical miles
2. Distance since reset, nautical miles
3. Checksum

VTG - Course over ground and ground speed

COG and SOG obtained by processing the GPS signals.

\$GPVTG, x.x, T, x.x, M, x.x, N, x.x, K, p*hh<CR><LF>

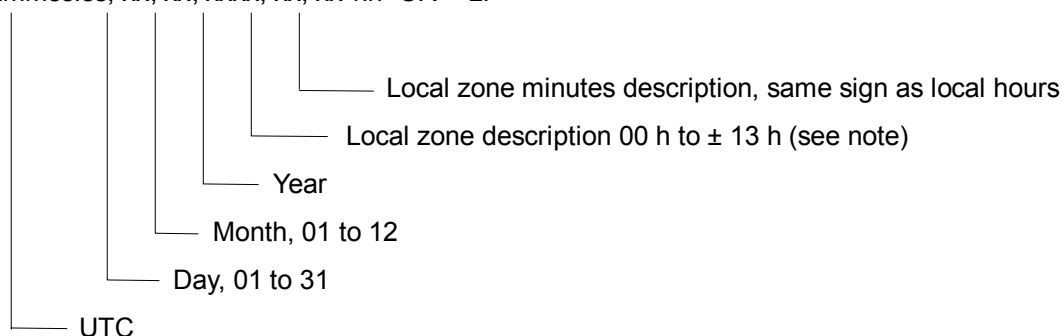


*A = Autonomous, D = Differential, E = estimated (dead reckoning), M = Manual input, S = Simulator, N = Data not valid. The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

ZDA - Time and date

UTC, day, month, year and local time zone.

\$GPZDA, hhmmss.ss, xx, xx, xxxx, xx, xx*hh<CR><LF>



NOTE - Zone description if the number of whole hours added to local time to obtain GMT. Zone description is negative for east longitudes.

3. Input/Output Ports

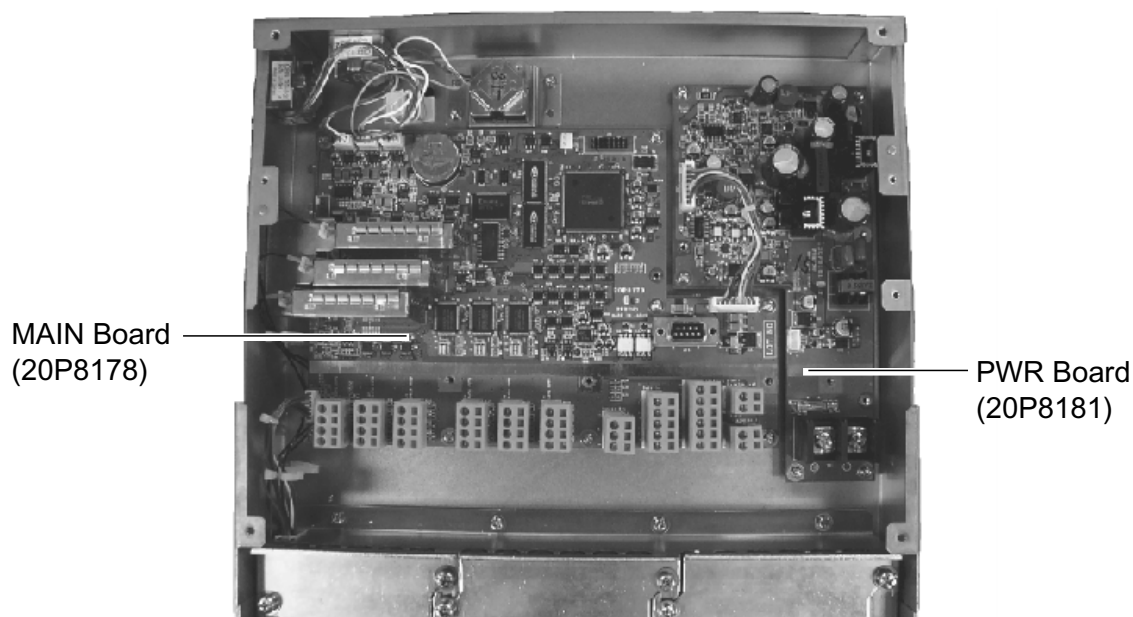
Port Label	Terminal Name	I/O	Signal	Remarks
DATA OUT1	WAGO 231-304/026-000	O	Heading, Speed, Course, Position, and Time	IEC61162(NMEA0183) or AD-10 format (software)
DATA OUT2	WAGO 231-304/026-000	O		IEC61162-1 (NMEA0183) Ver1.5, 2.0
DATA OUT3	WAGO 231-304/026-000	O		IEC61162-2
DATA OUT4	WAGO 231-304/026-000	O		Talker: GP, HE, HN,HC (HDT, HDM, ROT selectable; other sent. GP only)
DATA OUT5	WAGO 231-304/026-000	O		Speed: 4800, 9600, 19200, 38400 bps IEC61162 sentences: HDT, HDM, ROT, VTG, GGA, GLL, GNS, ZDA, VHW, VBW, VDR (on/off by menu) IEC61162 (NMEA0183) : sentence output interval : HDT, HDM, ROT : (25ms, 100ms, 200ms, 1s, 2s, selectable), VTG, GGA, GLL, GNS, ZDA, VHW, VBW, VDR : (1s, 2s, selectable) ATT sentence Proprietary sentence or FURUNO sentence Only P sentence : output rate of 25ms, 100ms,200ms, 1s, 2s, selectable ATT sentence – True heading, pitching, rolling \$PFEC,GPatt,xxx.x, +xx.x, +xx.x<CR><LF> (IEC61162-1 (NMEA0183) Ver1.5) \$PFEC,GPatt,xxx.x, +xx.x, +xx.x*hh<CR><LF> (IEC61162-1 (NMEA0183) ver 2.0, IEC61162-2) HVE sentence Proprietary sentence or FURUNO sentence Only P sentence : output rate of 25ms, 100ms,200ms, 1s, 2s, selectable HVE sentence – heave by wave \$PFEC,GPhve,xx.xxx,A<CR><LF> (IEC61162-1 (NMEA0183) Ver1.5) \$PFEC,GPhve,xx.xxx,A *hh<CR><LF> (IEC61162-1 (NMEA0183) ver 2.0, IEC61162-2) AD-10 output interval :25ms Sinal level : IEC61162 Heading data selected in the tech menu is output.

Port Label	Terminal Name	I/O	Signal	Remarks
DATA OUT6	WAGO 231-304/026-000	O	Heading	AD-10 only AD-10 output interval: 25ms
LOG/ ALARM	WAGO 231-306/026-000	O	LOG Signal	200 pulse/nm or 400 pulse/nm (software), 0.5A max.
			HDG alarm	Heading alarm, 0.5A max, normal close
DATA IN	WAGO 231-305/026-000	O	Heading	Heading data in either AD-10 or IEC61162(NMEA0183) format (4800, 9600, 19200, 38400bps) is automatically received. Priority of IEC61162(NMEA0183) sentence is HDT>HDG>HDM. The signal is selected through the menu during the period of internal heading sensor failure. VBW/VHW may be input from a current indicator.

4. Parts List and Parts Location

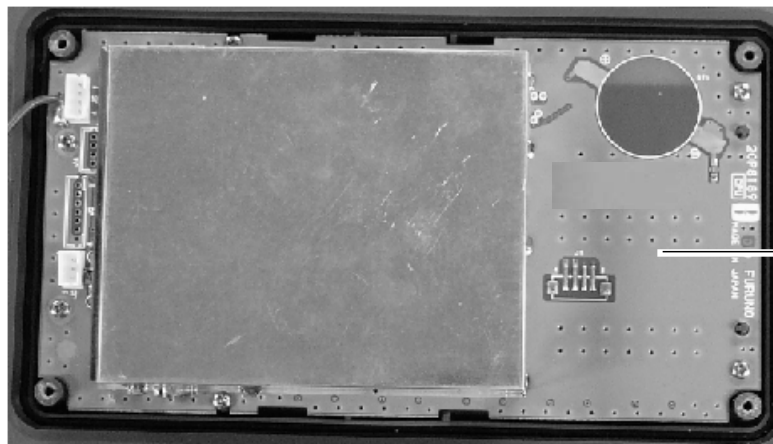
This equipment contains complex modules in which fault diagnosis and repair down to component level are not practical (IMO A.694(17)/8.3.1. Only some discrete components are used. FURUNO Electric Co., Ltd. believes identifying these components is of no value for shipboard maintenance; therefore, they are not listed in the manual. Major modules can be located on the parts location photo on this and then next page.

FURUNO	Model	SC-50		
	Unit	SC-501 PROCESSOR UNIT		
	Ref.Dwg.		Page	
	Blk.No.			
ELECTRICAL PARTS LIST				
SYMBOL	TYPE	CODE No.	REMARKS	SHIPPABLE ASSEMBLY
PRINTED CIRCUIT BOARD				
20P8178, MAIN				
20P8181, PWR				



Processor Unit, cover removed

FURUNO ELECTRICAL PARTS LIST	Model	SC-50/110		
	Unit	SC-502 DISPLAY UNIT		
	Ref.Dwg.		Page	
	Blk.No.			
SYMBOL	TYPE	CODE No.	REMARKS	SHIPPABLE ASSEMBLY
PRINTED CIRCUIT BOARD				
20P8189, CPU				



CPU Board
(20P8189)

Display Unit, cover opened

APPENDIX

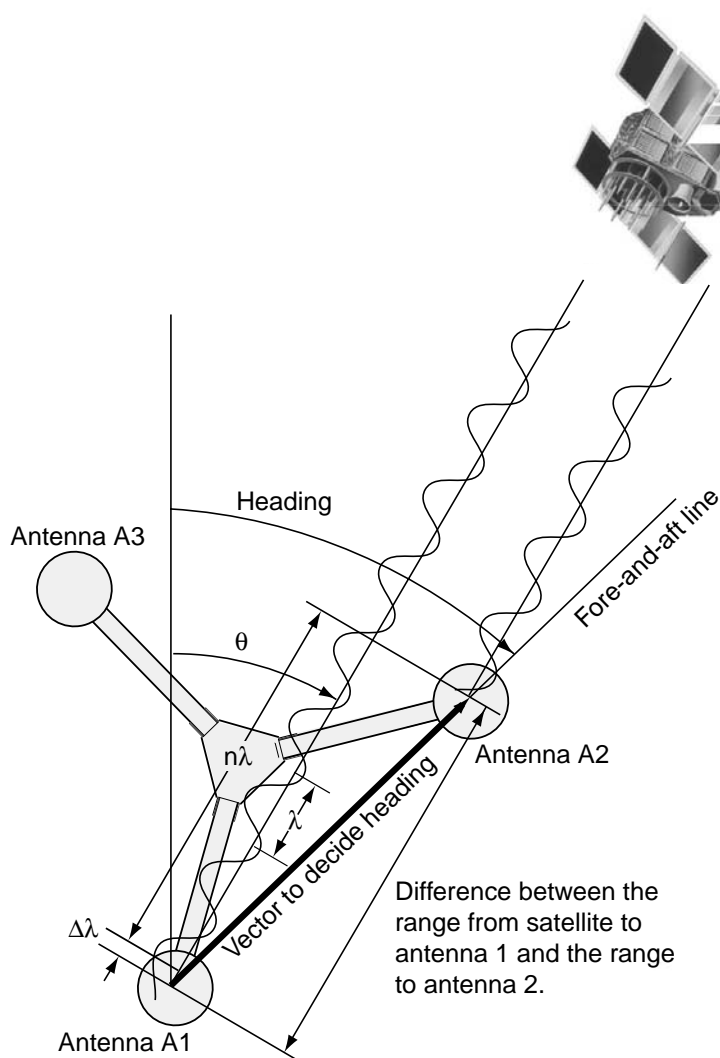
5. Geodetic Chart Codes

001 : WGS84		087 : MAPARIMA, BWI	: Trinidad and Tobago
002 : WGS72		088 : NORTH AMERICAN 1927	: Western United States
003 : TOKYO	: Mean Value (Japan, Korea, and Okinawa)	089 :	: Eastern United States
004 : NORTH AMERICAN 1927	: Mean Value (CONUS)	090 :	: Alaska
005 : EUROPEAN 1950	: Mean Value	091 :	: Bahamas (Excluding San Salvador Island)
006 : AUSTRALIAN GEODETIC 1984	: Australia and Tasmania Island	092 :	: Bahamas • • San Salvador Island
007 : ADINDAN	: Mean Value(Ethiopia and Sudan)	093 :	: Canada (Including Newfoundland Island)
008 :	: Ethiopia	094 :	: Alberta and British Columbia
009 :	: Mali	095 :	: East Canada
010 :	: Senegal	096 :	: Manitoba and Ontario
011 :	: Sudan	097 :	: Northwest Territories and Saskatchewan
012 : AFG	: Somalia	098 :	: Yukon
013 : AIN EL ABD 1970	: Bahrain Island	099 :	: Canal Zone
014 : ANNA 1 ASTRO 1965	: Cocos Island	100 :	: Caribbean
015 : ARC 1950	: Mean Value	101 :	: Central America
016 :	: Botswana	102 :	: Cuba
017 :	: Lesotho	103 :	: Greenland
018 :	: Malawi	104 :	: Mexico
019 :	: Swaziland	105 : NORTH AMERICAN 1983	: Alaska
020 :	: Zaire	106 :	: Canada
021 :	: Zambia	107 :	: CONUS
022 :	: Zimbabwe	108 :	: Mexico, Central America
023 : ARC 1960	: Mean Value (Kanya, Tanzania)	109 : OBSERVATORIO 1966	: Corvo and Flores Islands (Azores)
024 :	: Kenya	110 : OLD EGYPTIAN 1930	: Egypt
025 :	: Tanzania	111 : OLD HAWAIIAN	: Mean Value
026 : ASCENSION ISLAND 1958	: Ascension Island	112 :	: Hawaii
027 : ASTRO BEACON "E"	: Iwo Jima Island	113 :	: Kauai
028 : ASTRO B4 SOR. ATOLL	: Tern Island	114 :	: Maui
029 : ASTRO POS 71/4	: St. Helena Island	115 :	: Oahu
030 : ASTRONOMIC STATION 1952	: Marcus Island	116 : OMAN	: Oman
031 : AUSTRALIAN GEODETIC 1966	: Australia and Tasmania Island	117 : ORDNANCE SURVEY OF GREAT BRITAIN 1936	: Mean Value
032 : BELLEVUE (IGN)	: Efate and Erromango Islands	118 :	: England
033 : BERMUDA 1957	: Bermuda Islands	119 :	: England, Isle of Man, and Wales
034 : BOGOTA OBSERVATORY	: Colombia	120 :	: Scotland and Shetland Islands
035 : CAMPO INCHAUSPE	: Argentina	121 :	: Wales
036 : CANTON ISLAND 1966	: Phoenix Islands	122 : PICO DE LAS NIVIES	: Canary Islands
037 : CAPE	: South Africa	123 : PITCAIRN ASTRO 1967	: Pitcairn Island
038 : CAPE CANAVERAL	: Mean Value (Florida and Bahama Islands)	124 : PROVISIONAL SOUTH CHILEAN 1963	: South Chile (near 53° s)
039 : CARTHAGE	: Tunisia	125 : PROVISIONAL SOUTH AMERICAN 1956	: Mean Value
040 : CHATHAM 1971	: Chatham Island (New Zealand)	126 :	: Bolivia
041 : CHUA ASTRO	: Paraguay	127 :	: Chile • • Northern Chile (near 19° s)
042 : CORREGO ALEGRE	: Brazil	128 :	: Chile • • Southern Chile (near 43° s)
043 : JAKARTA (BATAVIA)	: Sumatra Island (Indonesia)	129 :	: Colombia
044 : DOS 1968	: Gizo Island (New Georgia Island)	130 :	: Ecuador
045 : EASTER ISLAND 1967	: Easter Island	131 :	: Guyana
046 : EUROPEAN 1950 (Cont'd)	: Western Europe	132 :	: Peru
047 :	: Cyprus	133 :	: Venezuela
048 :	: Egypt	134 : PUERTO RICO	: Puerto Rico and Virgin Islands
049 :	: England, Scotland, Channel, and Shetland Islands	135 : QATAR NATIONAL	: Qatar
050 :	: England,Ireland, Scotland, and Shetland Islands	136 : QORNOQ	: South Greenland
051 :	: Greece	137 : ROME 1940	: Sardinia Islands
052 :	: Iran	138 : SANTNA BRAZ	: Sao Maguei, Santa Maria Islands (Azores)
053 :	: Italy • • Sardinia	139 : SANTO (DOS)	: Espirito Santo Island
054 :	: Italy • • Sicily	140 : SAPPER HILL 1943	: East Falkland Island
055 :	: Norway and Finland	141 : SOUTH AMERICAN 1969	: Mean Value
056 :	: Portugal and Spain	142 :	: Argentina
057 : EUROPEAN 1979	: Mean Value	143 :	: Bolivia
058 : GANDAJIKA BASE	: Republic of Maldives	144 :	: Brazil
059 : GEODETIC DATUM 1949	: New Zealand	145 :	: Chile
060 : GUAM 1963	: Guam Island	146 :	: Colombia
061 : GUX 1 ASTRO	: Guadalcanal Island	147 :	: Ecuador
062 : HJORSEY 1955	: Iceland	148 :	: Guyana
063 : HONG KONG 1963	: Hong kong	149 :	: Paraguay
064 : INDIAN	: Thailand and Vietnam	150 :	: Peru
065 :	: Bangladesh, India, and Nepal	151 :	: Trinidad and Tobago
066 : IRELAND 1956	: Ireland	152 :	: Venezuela
067 : ISTS 073 ASTRO 1969	: Diego Garcia	153 : SOUTH ASIA	: Singapore
068 : JHONSTON ISLAND 1961	: Jhonston Island	154 : SOUTHEAST BASE	: Porto Santo and Madeira Islands
069 : KANDAWALA	: Sri Lanka	155 : SOUTHWEST BASE	: Falai, Graciosa,Pico, Sao Jorge, and Terceira Islands
070 : KERGUELEN ISLAND	: Kerguelen Island	156 : TIMBALAI 1948	: Brunel and East Malaysia (Sarawak and Sadah)
071 : KERTAU 1948	: West Malaysia and Singapore	157 : TOKYO	: Japan
072 : LA REUNION	: Mascarene Island	158 :	: Korea
073 : L.C. 5 ASTRO	: Cayman Brac Island	159 :	: Okinawa
074 : LIBERIA 1964	: Liberia	160 : TRISTAN ASTRO 1968	: Tristan da Cunha
075 : LUZON	: Philippines (Excluding Mindanao Island)	161 : VITI LEVU 1916	: Viti Levu Island (Fiji Islands)
076 :	: Mindanao Island	162 : WAKE-ENIWETOK 1960	: Marshall Islands
077 : MAHE 1971	: Mahe Island	163 : ZANDERIJ	: Suriname
078 : MARCO ASTRO	: Salvage Islands	164 : BUKIT RIMPAH	: Bangka and Belitung Islands (Indonesia)
079 : MASSAWA	: Eritrea (Ethiopia)	165 : CAMP AREA ASTRO	: Camp Mcmurdo Area, Antarctica
080 : MERCHICH	: Morocco	166 : G. SEGARA	: Kalimantan Islands(Indonesia)
081 : MIDWAY ASTRO 1961	: Midway Island	167 : HERAT NORTH	: Afghanistan
082 : MINNA	: Nigeria	168 : HU-TZU-SHAN	: Taiwan
083 : NAHRWAN	: Masirah Island(Oman)	169 : TANANARIVE OBSERVATORY 1925	: Madagascar
084 :	: United Arab Emirates	170 : YACARE	: Uruguay
085 :	: Saudi Arabia	171 : RT-90	: Sweden
086 : NAMIBIA	: Namibia	172 : PULKOVO 1942	: Russia
		173 : FINNISH KKJ	: Finland

6. Principle of Satellite Compass

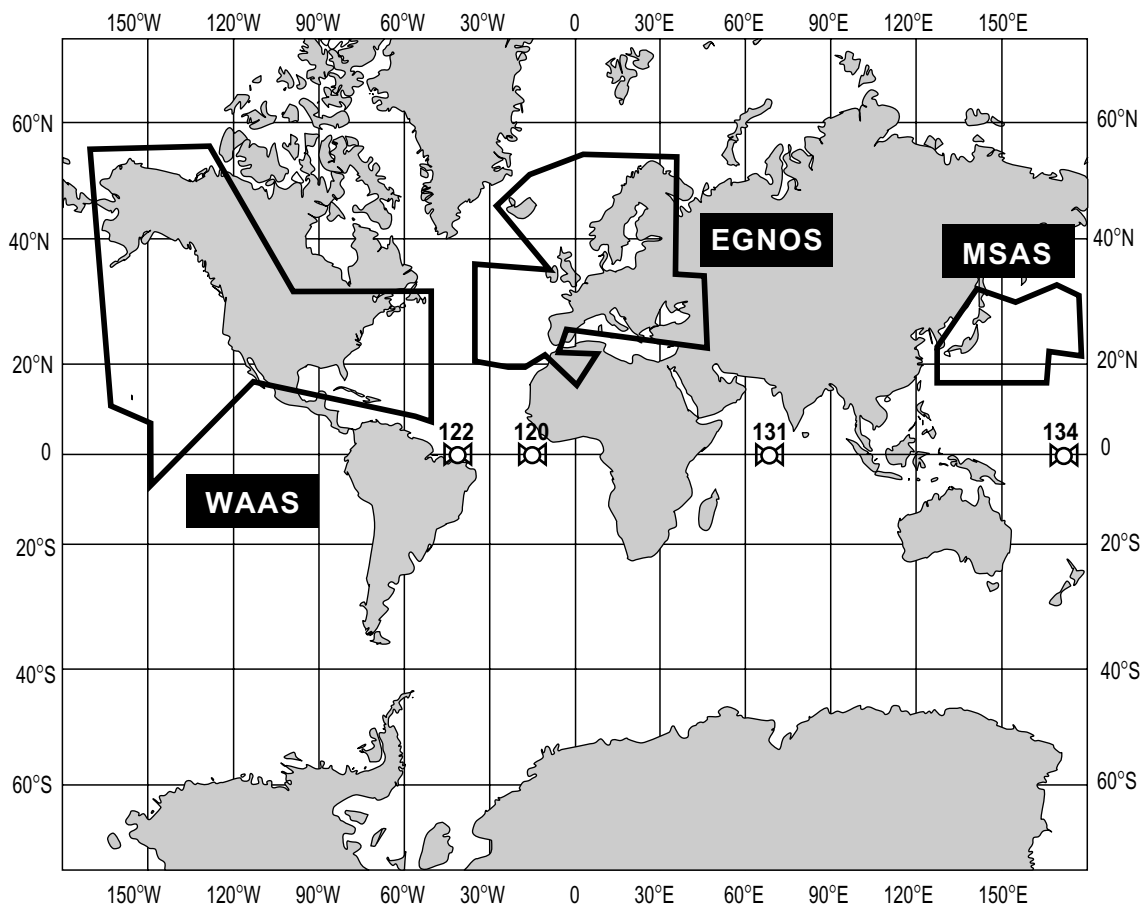
Own ship's heading can be determined by decoding the data in the carrier frequency in addition to ordinary GPS parameters. In principle, a pair of two antennas A1(ref) and A2(fore), each connected with an associated GPS engine and processor, are installed along the ship's fore-and-aft line. GPS systems at A1 and A2 calculate the range and azimuth to the satellite. Difference in range between A1 and A2 is $\Delta\lambda + n\lambda$ where λ is 19 cm. "n" is automatically found during the initialization stage by receiving three satellites. A fraction of a carrier wavelength, $\Delta\lambda$, is processed by FURUNO's advanced kinematic technology in geographical survey, thus determining a vector (range and orientation) A1 to A2.

In reality, a third antenna is used to reduce the influence of pitch, roll and yaw, and five satellites are processed to process 3D data. If the GPS signal is blocked by a tall building or the vessel is under a bridge, the 3-axis solid-state angular rate gyros in the processor unit take place of the satellite compass, maintaining the current heading continuously.



7. What is WAAS?

WAAS, available in North America, is a provider in the worldwide SBAS (Satellite Based Augmentation System) navigation system. SBAS provides GPS signal corrections to SBAS users, for even better position accuracy, typically better than three meters. Two more SBAS providers are also currently under development, MSAS (Multi-Functional Satellite Augmentation System) for Japan and EGNOS (Euro Geostationary Navigation Overlay Service) for Europe. All providers will be compatible with one another, thus providing “seamless” position fixes to SBAS users.



Satellite, Region	Position
120, AOR-E	15.5°W
122, AOR-W	54°W
131, IOR	64.5°E
134, POR	178°E


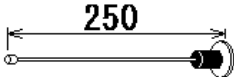

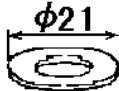
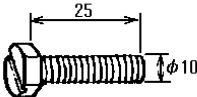
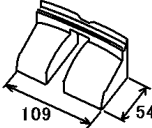
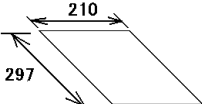
At the time of this software release, only WAAS is operational. During the developmental period in other areas, which may last for several years, there is no guarantee of the accuracy, integrity, continuity, or availability of the SBAS signal. Furuno will accept no responsibility for the use of the signal for other than the above stated purpose. It is the user's responsibility to exercise common prudence and navigational judgment while using the SBAS signal.

Note: This manual uses “WAAS” when referring to any SBAS provider.

PACKING LIST

20AY-X-9854 -3 1/1

SC-303

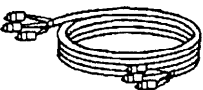
N A M E	O U T L I N E	DESCRIPTION/CODE	Q'TY
ユニット UNIT			
GPSアンテナ GPS ANTENNA		SC-303 000-041-925	1
工事材料 INSTALLATION MATERIALS CP20-02231			
鳥よけ BIRD-REPELLENT FIXTURE		20-024-3101-3 100-315-303	9
ハネ座金 SPRING WASHER		M10 SUS304 000-864-261	4
ミカキ平座金 FLAT WASHER		M10 SUS304 000-864-131	4
六角ボルト 刈割 HEX.BOLT (SLOTTED HEAD)		M10X25 SUS304 000-862-308	4
ケーブルカバー CABLE COVER		20-020-3213-1 100-291-511	1
図書 DOCUMENT			
型紙 TEMPLATE		C72-00303- 000-149-150	1

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

20AY-X-9854

FURUNO

CODE NO.	004-378-110	20AT-X-9408-0
TYPE	CP20-02230	1/1

工事材料表 INSTALLATION MATERIALS					
番号 NO.	名称 NAME	略 図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ケーブル組品 CABLE ASSY.	 L=15M	TPPX6-3D2V-15M	1	
			CODE NO. 000-143-559		

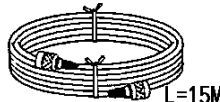
DWG NO.

C7248-M06- A

FURUNO ELECTRIC CO., LTD.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

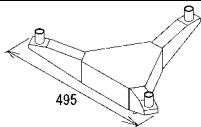
FURUNO

		CODE NO.	004-379-660	20AT-X-9410 -0		
		TYPE	CP20-02260	1/1		
工事材料表 INSTALLATION MATERIALS						
番号 NO.	名 称 NAME	略 図 OUTLINE	型名 / 規格 DESCRIPTIONS		数量 Q'TY	用途 / 備考 REMARKS
1	ケーブル組品 ANTENNA CABLE ASSY.	 L=15M	TNC-PS-3D-15 20S0216		3	
			CODE NO.	000-133-670		

20AT-X-9410

FURUNO ELECTRIC CO., LTD.
 (略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

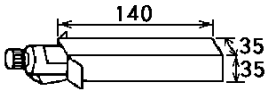
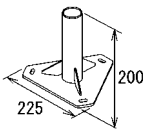
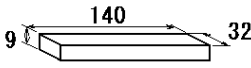
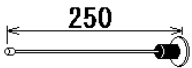

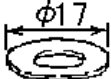
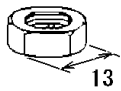
		CODE NO.	004-377-570	20AT-X-9401 -1 1/1	
		TYPE	CP20-02201		
工事材料表 INSTALLATION MATERIALS					
番 号 NO.	名 称 NAME	略 図 OUTLINE	型名 / 規格 DESCRIPTIONS	数量 Q'TY	用途 / 備考 REMARKS
1	アンテナベース組品(S) ANTENNA BASE ASSY.(S)		CP20-02201	1	
			CODE NO. 004-377-570		

20AT-X-9401

FURUNO ELECTRIC CO., LTD.
 (略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	004-377-590	20AT-X-9404 -4 1/1
TYPE	CP20-02202	

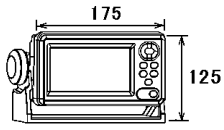

工事材料表 INSTALLATION MATERIALS					用途 / 備考 REMARKS
番号 NO.	名称 NAME	略図 OUTLINE	型名 / 規格 DESCRIPTIONS	数量 Q'TY	
1	シリボント SEALANT		1211 50G CODE NO. 000-854-118	1	
2	固定用金具S MOUNTING BASE		20-019-3351-2 CODE NO. 100-284-842	1	
3	補助金具 ATTACHMENT PLATE		20-019-3352-1 CODE NO. 100-284-851	1	
4	鳥よけ BIRD-REPELLENT FIXTURE		20-024-3101-3 CODE NO. 100-315-303	4	
5	バネ座金 SPRING WASHER		M8 SUS304 CODE NO. 000-864-262	3	
6	ミガキ平座金 FLAT WASHER		M8 SUS304 CODE NO. 000-864-130	3	
7	六角ナット 1種 HEX.NUT		M8 SUS304 CODE NO. 000-863-110	6	

20AT-X-9404

FURUNO ELECTRIC CO., LTD.
(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

P A C K I N G L I S T

SC-502-J/E

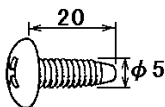
N A M E		O U T L I N E		DESCRIPTION/CODE		Q'TY	
ユニット		UNIT					
表示部 DISPLAY UNIT				SC-502-J		1	
				000-041-906 **			
工事材料		INSTALLATION MATERIALS					
工事材料 INSTALLATION MATERIALS				CP20-02203		1	
				004-380-660			

1.コード番号末尾の[**]は、選択品の代表型式/コードを表します。

CODE NUMBER ENDED BY "**" INDICATES THE NUMBER OF TYPICAL MATERIAL.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

		CODE NO.	004-380-660	20AY-X-9404 -0		
		TYPE	CP20-02203	1/1		
工事材料表 INSTALLATION MATERIALS						
番号 NO.	名 称 NAME	略 図 OUTLINE	型名 / 規格 DESCRIPTIONS		数量 Q'TY	用途 / 備考 REMARKS
1	+トラスタッピ [®] ンネジ [®] +TAPPING SCREW		5X20 SUS304 1ｼｭ		4	
			CODE NO.	000-802-081		

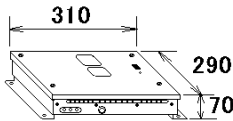


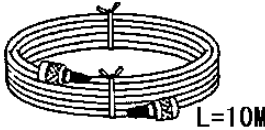
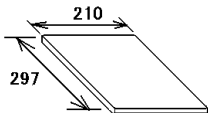
20AY-X-9404

FURUNO ELECTRIC CO., LTD.
 (略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

P A C K I N G L I S T

20AY-X-9852 -1 1/1

SC-501-J/E

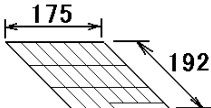
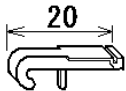
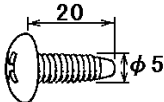
N A M E	O U T L I N E	DESCRIPTION/CODE	Q'TY
ユニット	UNIT		
演算部 PROCESSOR UNIT		SC-501 000-041-903	1
予備品	SPARE PARTS		
予備品 SPARE PARTS		SP20-01101 004-379-720	1
工事材料	INSTALLATION MATERIALS		
工事材料 INSTALLATION MATERIALS		CP20-02601 004-380-560	1
その他工材	OTHER INSTALLATION MATERIALS		
ケーブル組品MJ CABLE ASSY.		MJ-A7SPF0006-100 000-143-578	1
図書	DOCUMENT		
取扱説明書(和) OPERATOR'S MANUAL		OMJ-72510- 000-148-547 **	1

コード番号末尾の[**]は、選択品の代表型式/コードを表します。
CODE NUMBER ENDED BY "**" INDICATES THE NUMBER OF TYPICAL MATERIAL.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	004-380-560	20AY-X-9401 -1 1/1
TYPE	CP20-02601	

工事材料表						
INSTALLATION MATERIALS						
番 号 NO.	名 称 NAME	略 図 OUTLINE	型名 / 規格 DESCRIPTIONS		数量 Q'TY	用途 / 備考 REMARKS
1	ケーブルラベル CABLE LABEL		20-024-2024-0		1	
			CODE NO.	100-310-770		
2	操作レバー TERMINAL OPENER		231-131		2	
			CODE NO.	000-808-981		
3	+トラスタップネジ +TAPPING SCREW		5X20 SUS304 1/2		4	
			CODE NO.	000-802-081		

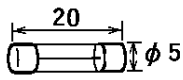
20AY-X-9401

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO ELECTRIC CO., LTD.

FURUNO

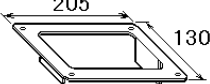
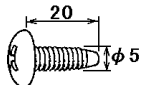

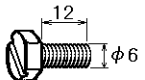
CODE NO.	004-379-720	20AY-X-9301 -0 1/1
TYPE	SP20-01101	BOX NO. P

SHIP NO.		SPARE PARTS LIST FOR		U S E			SETS PER VESSEL	
ITEM NO.	NAME OF PART	OUTLINE	DWG. NO. OR TYPE NO.	QUANTITY			REMARKS/CODE NO.	
				WORKING		SPARE		
				PER SET	PER VES			
1	ヒューズ FUSE		FGMB 3A 125V			3		
							000-104-909	
MFR'S NAME		FURUNO ELECTRIC CO.,LTD.		DWG NO.		20AY-X-9301		
						1/1		

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

FURUNO

CODE NO.	000-041-405	20AY-X-9402 -0 1/1
TYPE	OP20-29	

フラッシュマウントキット FLUSH MOUNT KIT.						
番号 NO.	名称 NAME	略図 OUTLINE	型名 / 規格 DESCRIPTIONS	数量 Q'TY	用途 / 備考 REMARKS	
1	化粧パネル COSMETIC PANEL		20-016-1051-0	1		
			CODE NO. 100-251-370			
2	+トラスタップ・ンネジ TAPPING SCREW		5X20 SUS304 1種 ㊦	4		
			CODE NO. 000-802-840			
3	パネル座金 SPRING WASHER		M6 SUS304	2		
			CODE NO. 000-864-260			
4	六角ボルト スリ割り HEX.BOLT(SLOTTED HEAD)		M6X12 SUS304	2		
			CODE NO. 000-862-127			

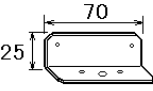
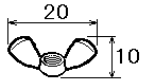

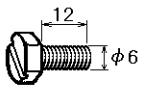
20AY-X-9402

FURUNO ELECTRIC CO., LTD.

(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)

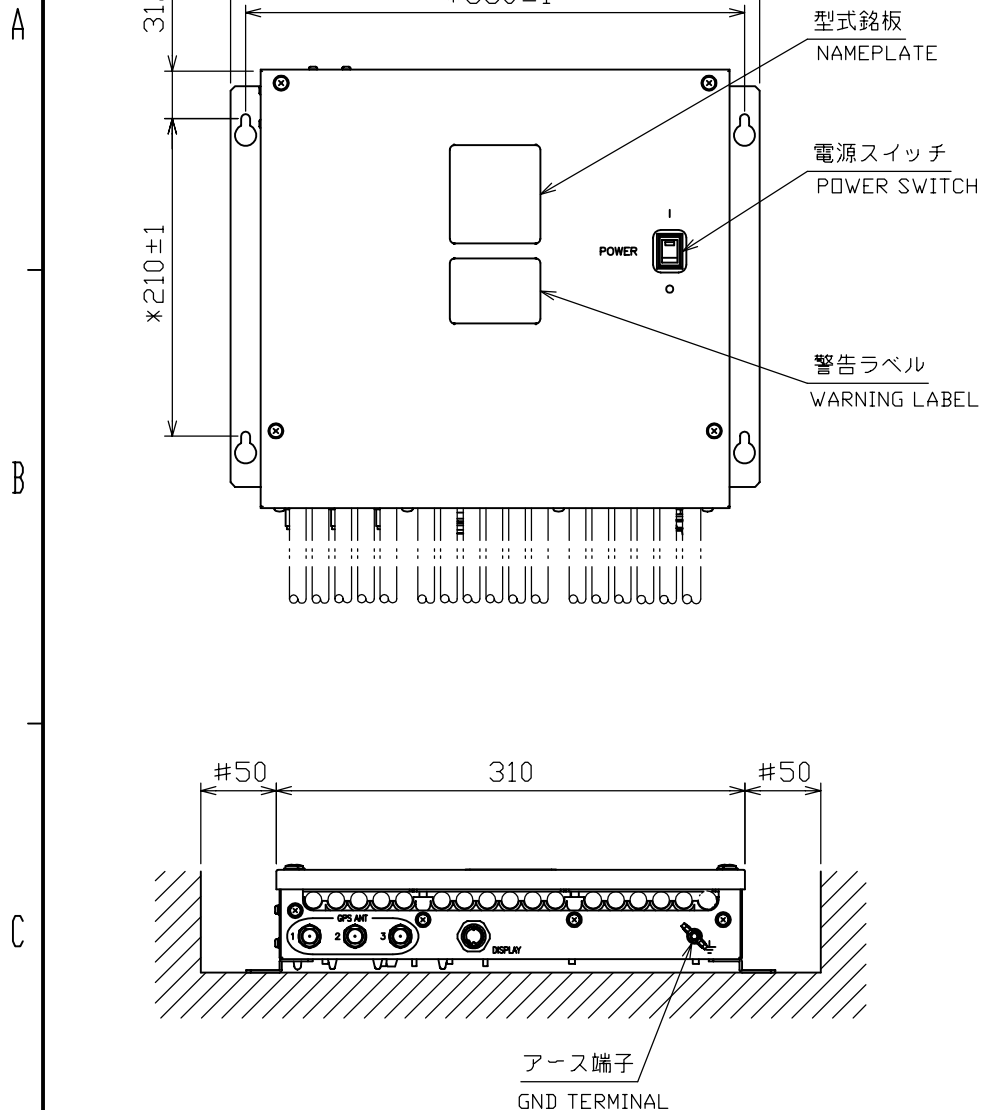
FURUNO

CODE NO.	000-040-720	20AY-X-9403 -0 1/1
TYPE	OP20-17	

フラッシュマウントキット FLUSH MOUNT KIT.					
番 号 NO.	名 称 NAME	略 図 OUTLINE	型名 / 規格 DESCRIPTIONS	数量 Q'TY	用途 / 備考 REMARKS
1	フラッシュマウント FIXING PLATE FOR FLUSH MOUNT		20-007-2401-0	2	
			CODE NO. 100-183-190		
2	蝶ナット WING NUT		M4 YBSC2 MBN12	4	
			CODE NO. 000-863-306		
3	蝶ボルト WING SCREW		M4X30 YBSC2 MBN12	4	
			CODE NO. 000-804-799		
4	バネ座金 SPRING WASHER		M6 SUS304	2	
			CODE NO. 000-864-260		
5	六角ボルト スリ割り HEX.BOLT(SLOTTED HEAD)		M6X12 SUS304	2	
			CODE NO. 000-862-127		

20AY-X-9403

FURUNO ELECTRIC CO., LTD.
(略図の寸法は、参考値です。 DIMENSIONS IN DRAWING FOR REFERENCE ONLY.)



注 記

- 1) *印寸法は取付穴位置寸法とする。
- 2) 取付用ネジはトラスタッピングネジ呼び径5×20を使用のこと。
- 3) 指定外寸法公差は表1による。
- 4) #印寸法は最小サービス空間寸法とする。

NOTE

1. *: DIMENSIONS FOR FIXING HOLE POSITIONS.
2. USE TAPPING SCREWS 5x20 FOR FIXING THE UNIT.
3. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
4. #: MINIMUM SERVICE CLEARANCE.

表 1 TABLE 1

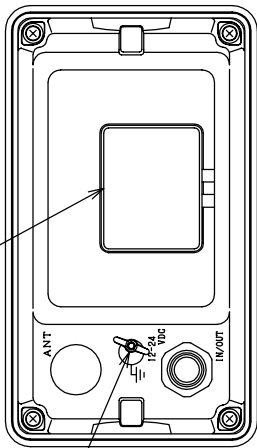
寸法区分 (mm) DIMENSIONS	公差 (mm) TOLERANCE
$0 < L \leq 50$	± 1.5
$50 < L \leq 100$	± 2.5
$100 < L \leq 500$	± 3

DRAWN Jan. 15 '04 E. MIYOSHI		TITLE SC-501/1101
CHECKED Takahashi T.		名称 演算部
APPROVED Y. Hatai	SC-50/110	外寸図
SCALE 1/5	MASS 4.2 $\pm 10\%$ kg	NAME PROCESSOR UNIT
DWG.No. C7251-G01-B	20-024-100G-2	OUTLINE DRAWING

表 1 TABLE 1

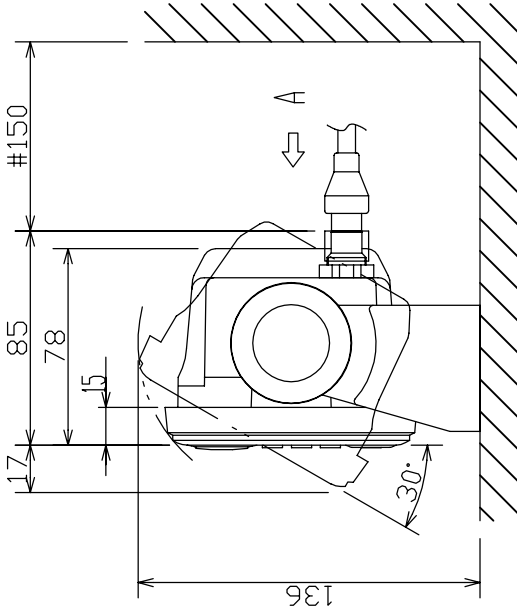
寸法区分 (mm) DIMENSION	公差 (mm) TOLERANCE
0 < L ≤ 50	±1.5
50 < L ≤ 100	±2.5
100 < L ≤ 500	±3

型式銘板
NAMEPLATE

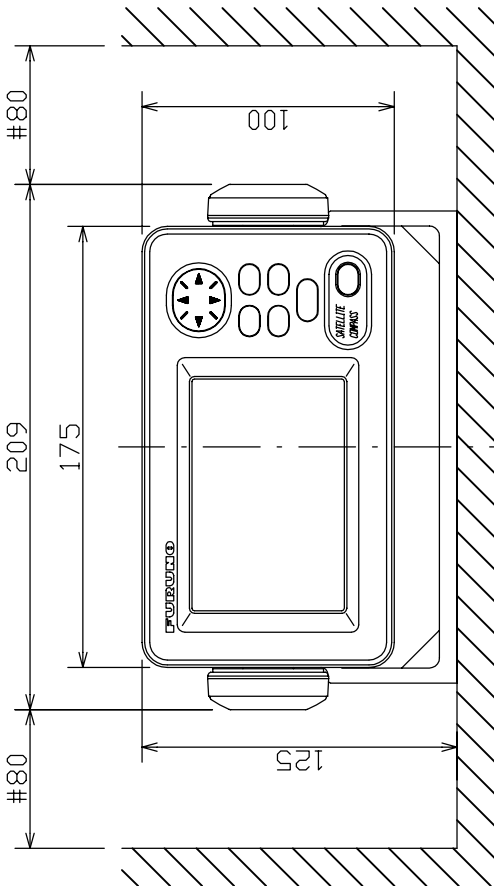
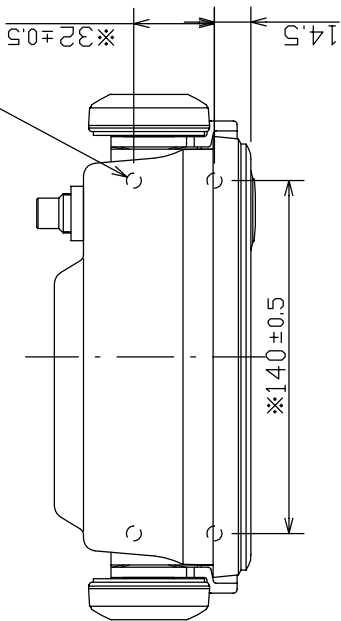


アース端子
GND TERMINAL

矢視 A VIEW A



4-φ6 取付穴
FIXING HOLES

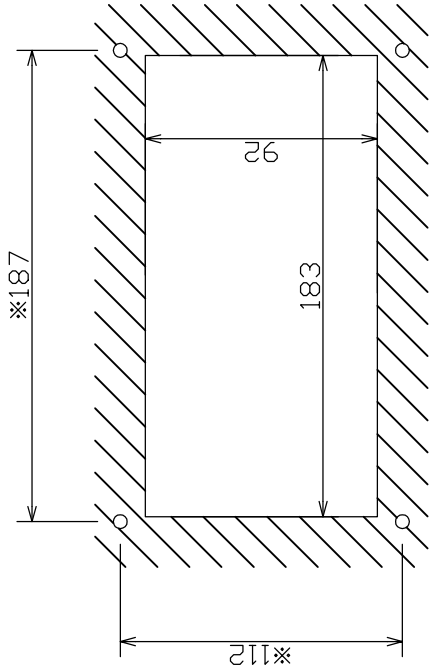
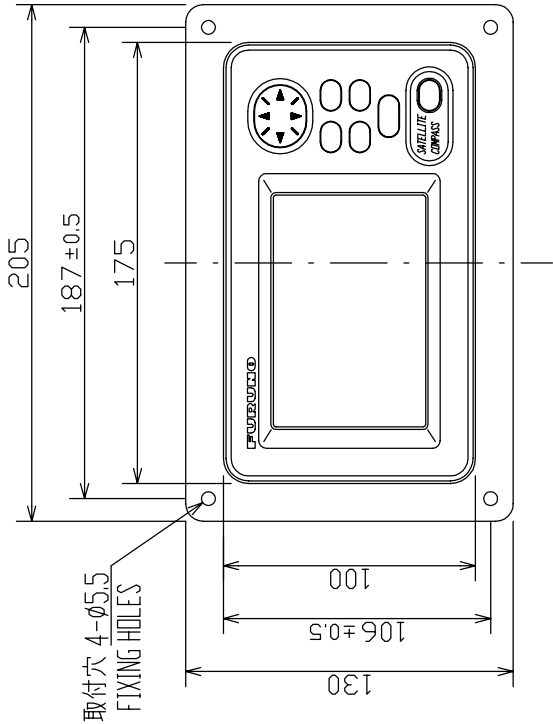
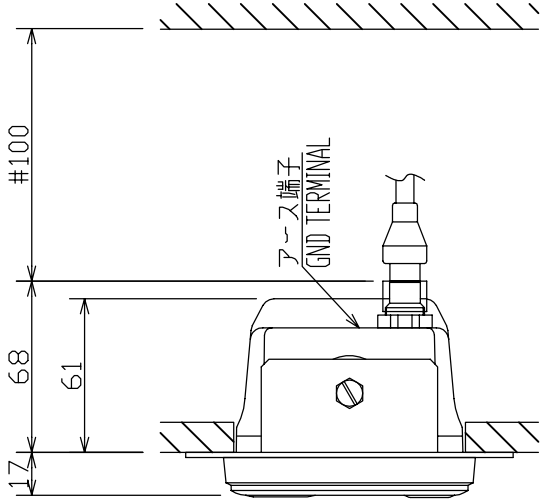


- 注 記
- 1) 装備ケーブルはサービス時、表示部を前方に十分引き出せるよう余裕を持たせること。
 - 2) ※印寸法は取付穴位置寸法とする。
 - 3) 取付用ネジはトラスタッピングネジ呼び径5×20を使用のこと。
 - 4) 指定外寸法公差は表 1 による。
 - 5) ※印寸法は最小サービス空間寸法とする。
- NOTE
1. KEEP SUFFICIENT CABLE LENGTH BEHIND THE UNIT FOR MAINTENANCE.
 2. ※ DIMENSIONS FOR FIXING HOLE POSITIONS.
 3. USE TAPPING SCREWS 5x20 FOR FIXING THE UNIT.
 4. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
 5. # MINIMUM SERVICE CLEARANCE.

DRAWN No. 17 04	E. MIYOSHI Takahashi T.	TITLE SC-502/602
CHECKED	SC-50/110	名称 表示部 (卓上装備)
APPROVED Y. Hatai	SC-60/120/155	外寸図
SCALE 1/3	100% 0.55 kg	NAME DISPLAY UNIT (DESKTOP MOUNT)
DocNo. C7248-G02-H	20-024-200G-0	OUTLINE DRAWING

表 1 TABLE 1

寸法区分 (mm) DIMENSIONS	公差 (mm) TOLERANCE
0 < L ≤ 50	±1.5
50 < L ≤ 100	±2.5
100 < L ≤ 500	±3



取付穴寸法図 (参考図)
CUTOUT DIMENSIONS

- 注 記
- ※印寸法は取付穴位置寸法とする。
 - 取付用ネジはトラスタッピングネジ呼び径5×20を使用のこと。
 - 指定外寸法公差は表 1 による。
 - ※印寸法は最小サービス空間寸法とする。

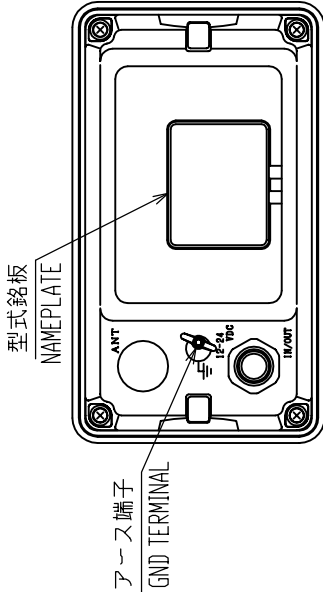
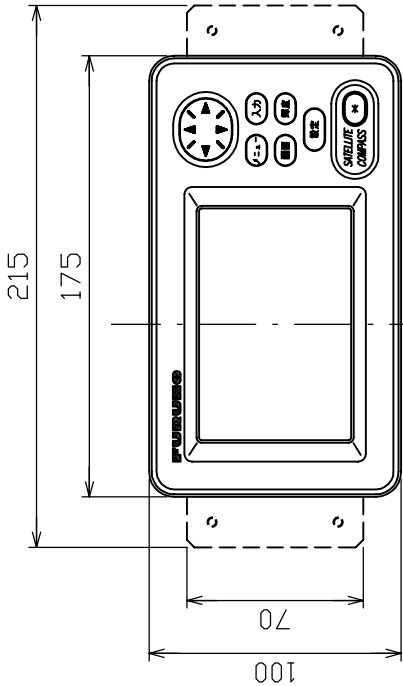
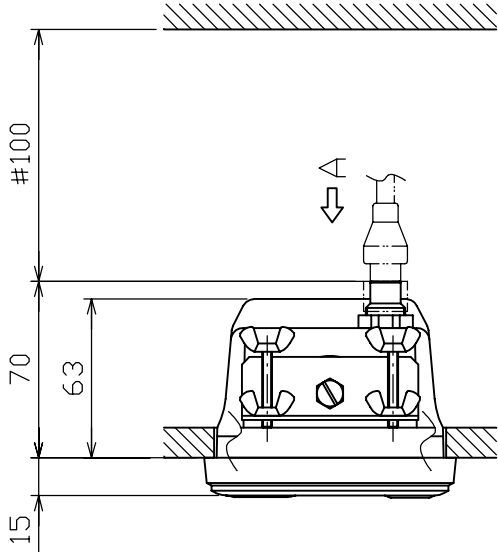
NOTE

- ※: DIMENSIONS FOR FIXING HOLE POSITIONS.
- USE TAPPING SCREWS 5x20 FOR FIXING THE UNIT.
- TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
- ※: MINIMUM SERVICE CLEARANCE.

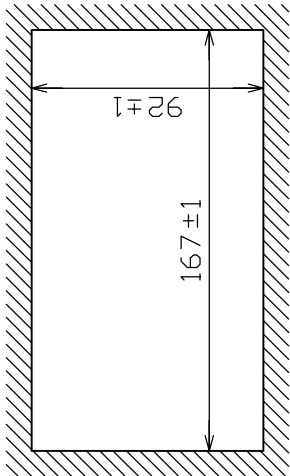
DRAWN No. 17-04	E. MIYOSHI Takahashi T.	TITLE SC-502/602
CHECKED		名称 表示部 (埋込装備 F)
APPROVED Y. Hatai	SC-50/100	外寸図
SCALE 1/3	SC-60/120/55	NAME DISPLAY UNIT (FLUSH MOUNT F)
DESIGN C7248-G03-G	20-024-210G-0	OUTLINE DRAWING

表 1 TABLE 1

寸法区分 (mm) DIMENSIONS	公差 (mm) TOLERANCE
L ≤ 50	±1.5
50 < L ≤ 100	±2.5
100 < L ≤ 500	±3



矢視 A
VIEW A



取付穴寸法図(参考図)
CUTOUT DIMENSIONS

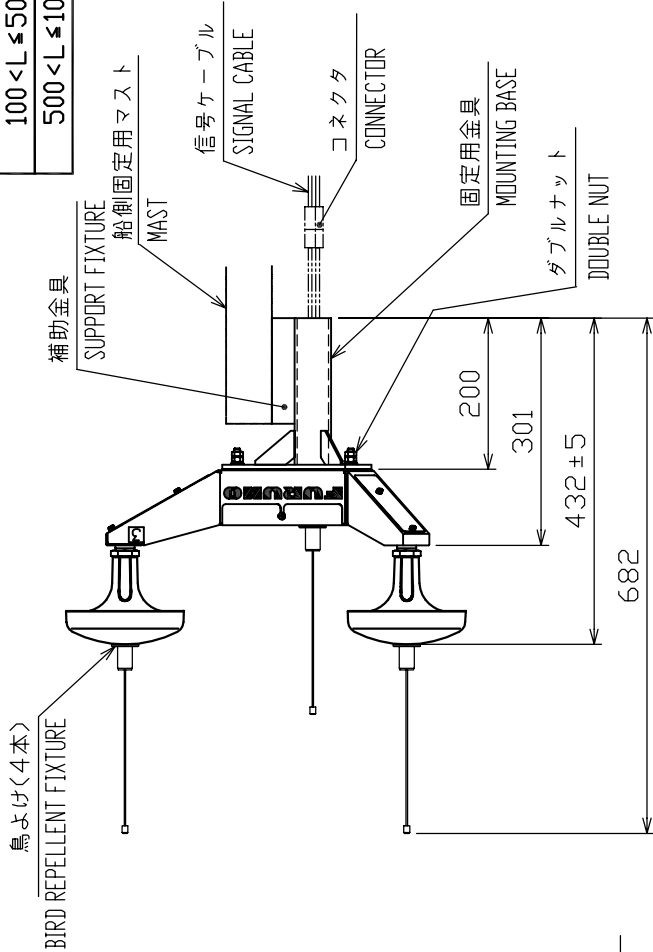
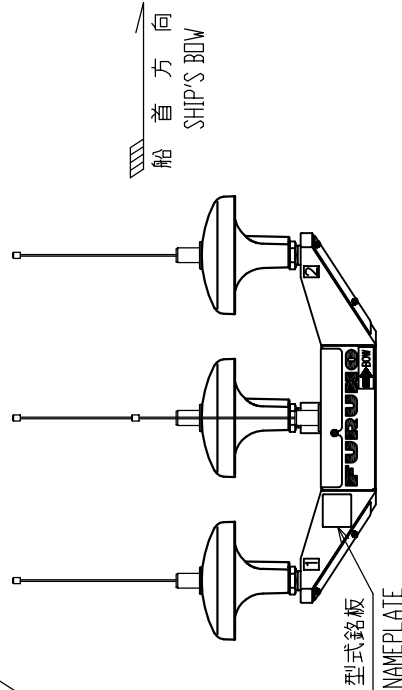
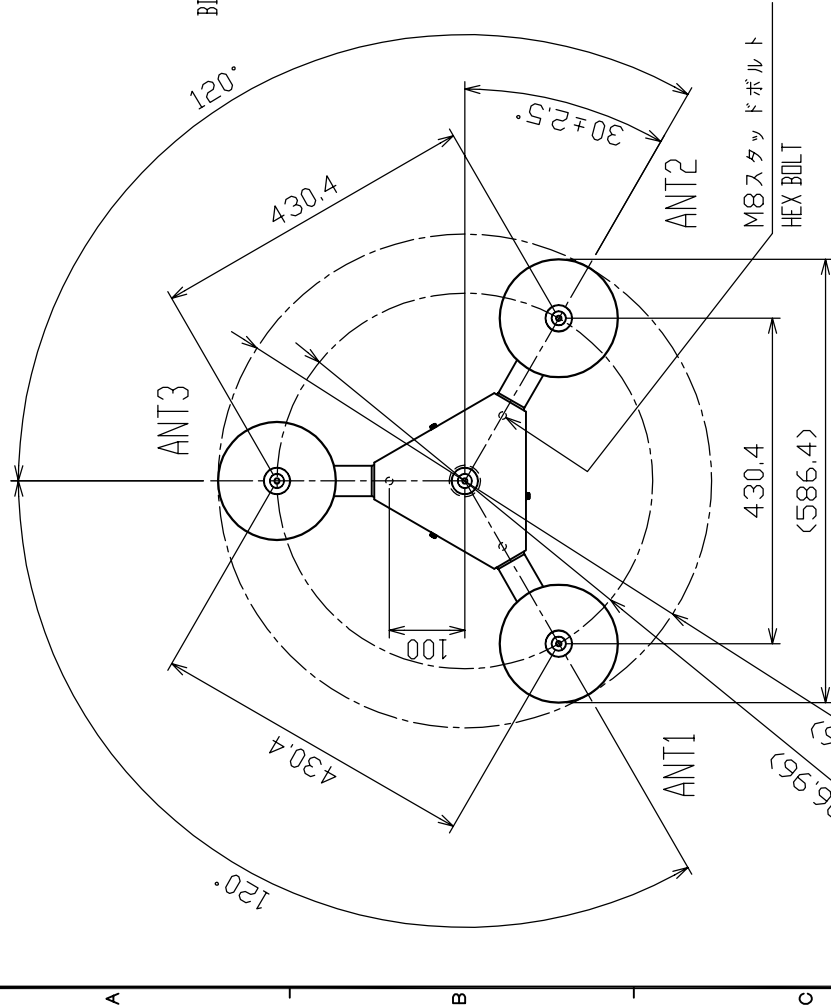
注 記 1) 指定外寸法公差は表 1 による。
2) # 印寸法は最小サービス空間寸法とする。

NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.
2. # MINIMUM SERVICE CLEARANCE.

DRAWN No. 12 '04	E. MIYOSHI	TITLE	SC-502/602
CHECKED	Takahashi T.	名称	表示部 (埋込装備 S)
APPROVED	Y. Hatai		外寸図
SCALE	1/3	NAME	DISPLAY UNIT (FLUSH MOUNT S)
Doc.No.	C7248-G04-F		OUTLINE DRAWING
			20-024-220G-0

表 1 TABLE 1

寸法区分 (mm) DIMENSIONS	公差 (mm) TOLERANCE
L ≤ 50	±1.5
50 < L ≤ 100	±2.5
100 < L ≤ 500	±3
500 < L ≤ 1000	±4



注 記 1) 指定外の寸法公差は表 1 による。

2) 取付けは補助金具を溶接し、しっかりと固定のこと。

3) 質量は工事材料く鳥よけ; 0.02kg × 4本、固定用金具; 2kg、補助金具、M8ナット、SW、PW、スリッポンF1211)を含まず。

NOTE 1. TABLE 1 INDICATES TOLERANCE OF DIMENSIONS WHICH IS NOT SPECIFIED.

2. WELD SUPPORT FIXTURE.

3. MASS DOES NOT INCLUDE INSTALLATION MATERIALS (BIRD-REPELLENT FIXTURE, 0.02 kg x 4 PCS; MOUNTING BASE, 2 kg; SUPPORT FIXTURE, M8 NUT, SPRING WASHER, FLAT WASHER, SILICONE RUBBER THREEBOND 1211).

DRAWN	MoC 11 04 E. MIYOSHI	TITLE	SC-603
CHECKED	TAKAHASHI. T	名称	空中線部
APPROVED	Y. Hatai	外寸図	
SCALE	1/10	NAME	ANTENNA UNIT
FIG No.	C7248-G05-D	20-019-310G-3	OUTLINE DRAWING

型式銘板

ANTENNA UNIT

空中線部

外寸図

NAME

FIG No.

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APPROVED

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DRAWN

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20-019-310G-3

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20-019-310G-3

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C7248-G05-D

20-019-310G-3

OUTLINE DRAWING

ANTENNA UNIT

空中線部

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NAME

FIG No.

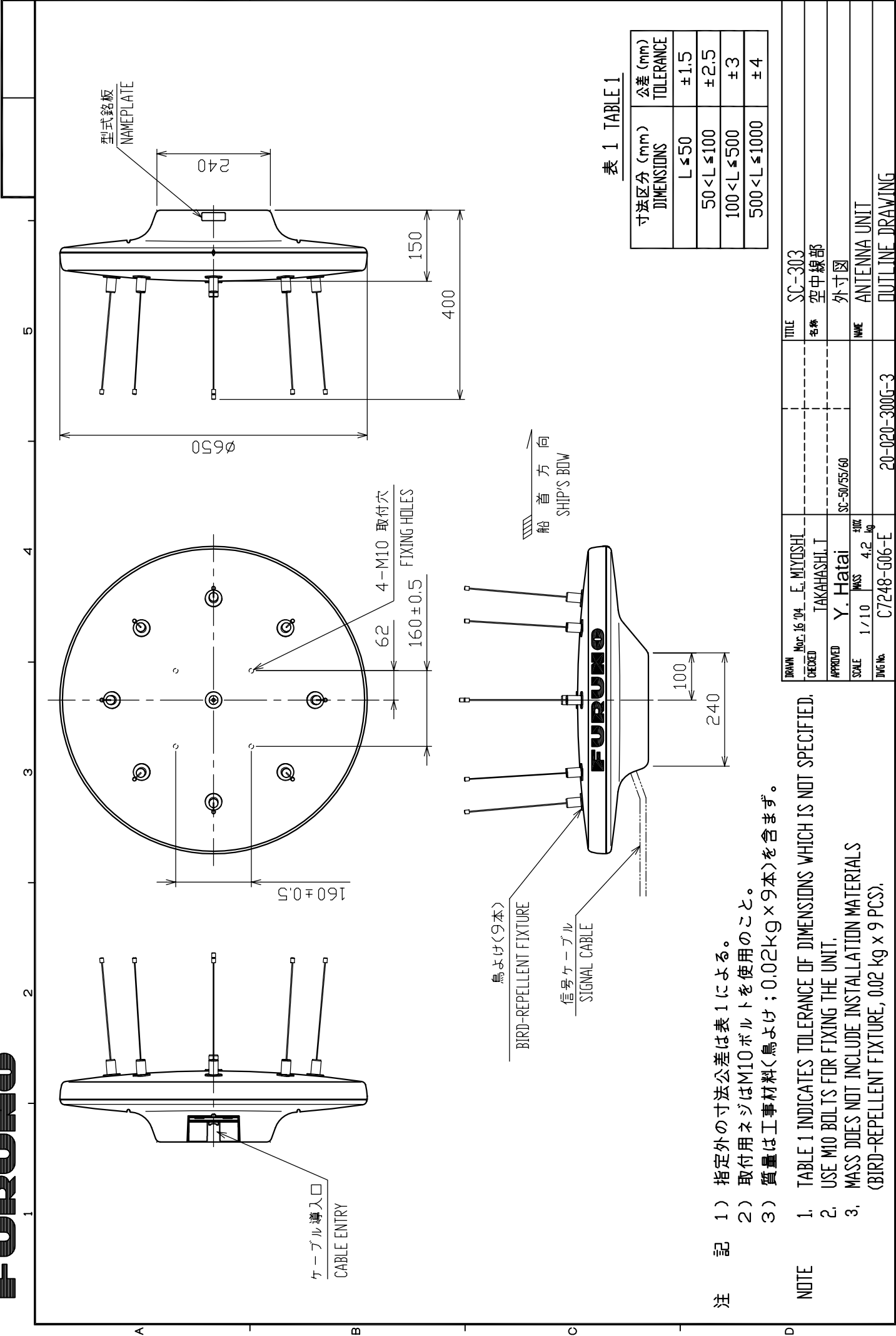
SCALE

APPROVED

CHECKED

DRAWN

MoC 11 04 E. MIYOSHI

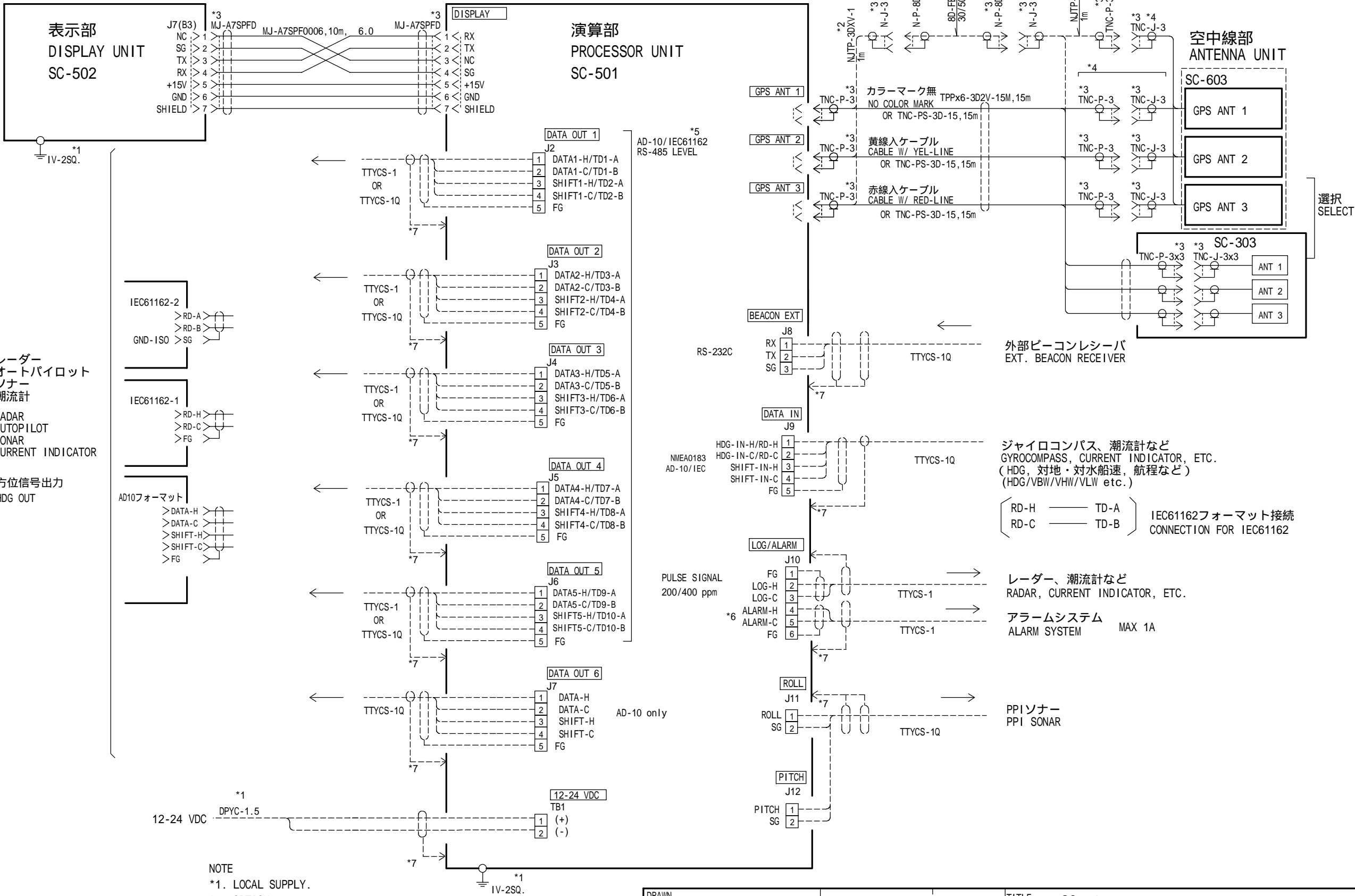


A

B

C

D



- 注記

 - * 1) 現地手配。
 - * 2) オプション。
 - * 3) 工場にて取付済み
 - * 4) 防水のためテープで処理すること。
 - * 5) メニュー切替。
 - * 6) 方位出力が停止したとき、接点回路がオープンになる。
 - * 7) ケーブルクランプでクランプする。
- NOTE

 - *1. LOCAL SUPPLY.
 - *2. OPTION.
 - *3. FITTED AT FACTORY.
 - *4. TAPE FOR WATERPLOOFING.
 - *5. CHANGE WITH MENU.
 - *6. IF THE HEADING OUTPUT STOPS, THE CONTACT CIRCUIT OPENS.
 - *7. CLAMP WITH CABLE CALMP.

DRAWN	Jun. 13, '05 E.MIYOSHI	TITLE	SC-50
CHECKED	TAKAHASHI.T	名称	サテライトコンパス
APPROVED	Y. Hatai		相互結線図
SCALE	MASS kg	NAME	SATELLITE COMPASS
DWG No.	C7251-C01- D		INTERCONNECTION DIAGRAM

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Declaration of ConformityWe **FURUNO ELECTRIC CO., LTD.**

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

declare under our sole responsibility that the product

Transmitting Heading Device: Satellite compass Models SC-50 and SC-110 consisting of
Processor unit SC-501 for SC-50 and SC-1101 for SC-110, Monitor unit SC-502 and Antenna unit
SC-303 or SC-603 for SC-50 and SC-1203F for SC-110

(Model name, serial number)

are in conformity with the essential requirements as described in the Directive 1999/5/EC of the
European Parliament and of the Council of 9 March 1999 on radio equipment and
telecommunications terminal equipment (R&TTE Directive) and satisfies all the technical regulations
applicable to the product within this Directive

EN 60945: 2002 (IEC 60945 Fourth edition: 2002-08)
EN 60950: 2000-01 (IEC 60950 Third edition: 1999-04)

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- Statement of Opinion N° 04214038/AA/00 of 20 February 2004 issued by Telefication, The Netherlands
- Test reports FLI 12-03-042 of 27 December 2003 and FLI 12-03-050 of 27 October 2003 prepared by Furuno Labotech International Co., Ltd.

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan
February 24, 2004

(Place and date of issue)

Hiroaki Komatsu
Manager,
International Rules and Regulations

(name and signature or equivalent marking of authorized person)